W. HUEBNER & O. KUNKEL.

AUTOMATIC STABILIZING AEROPLANE.

APPLICATION FILED JUNE 6, 1913.

1,131,380.

Patented Mar. 9, 1915.

4 SHEETS—SHEET 1.

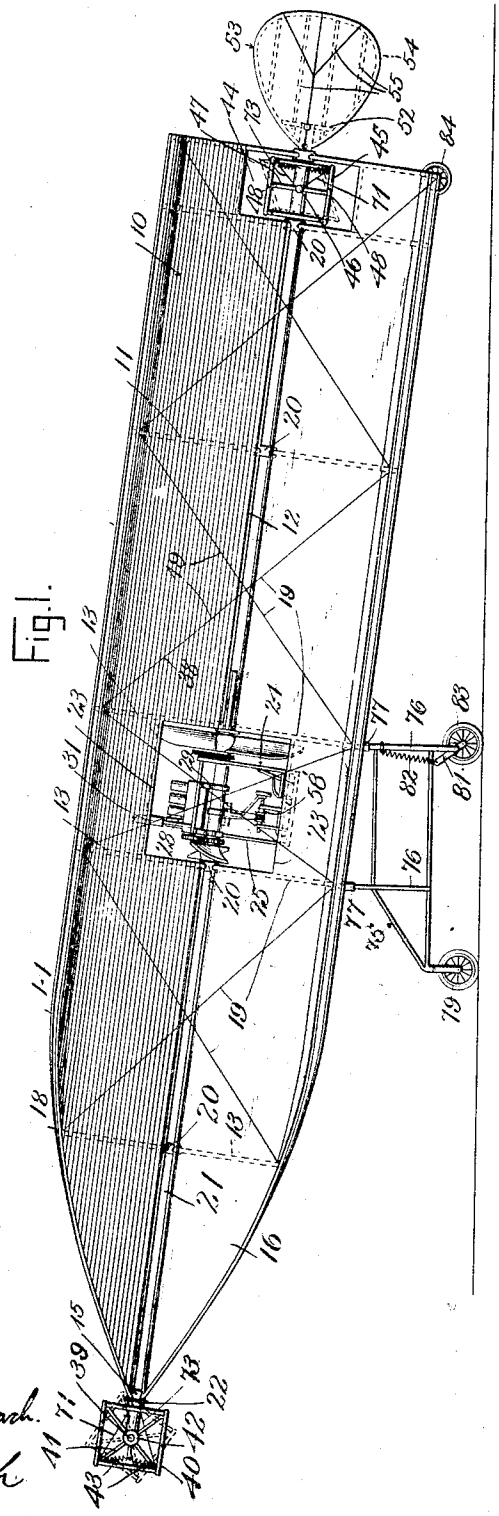


Fig. 1.

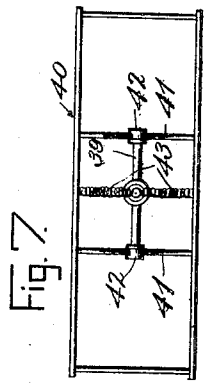


Fig. 7.

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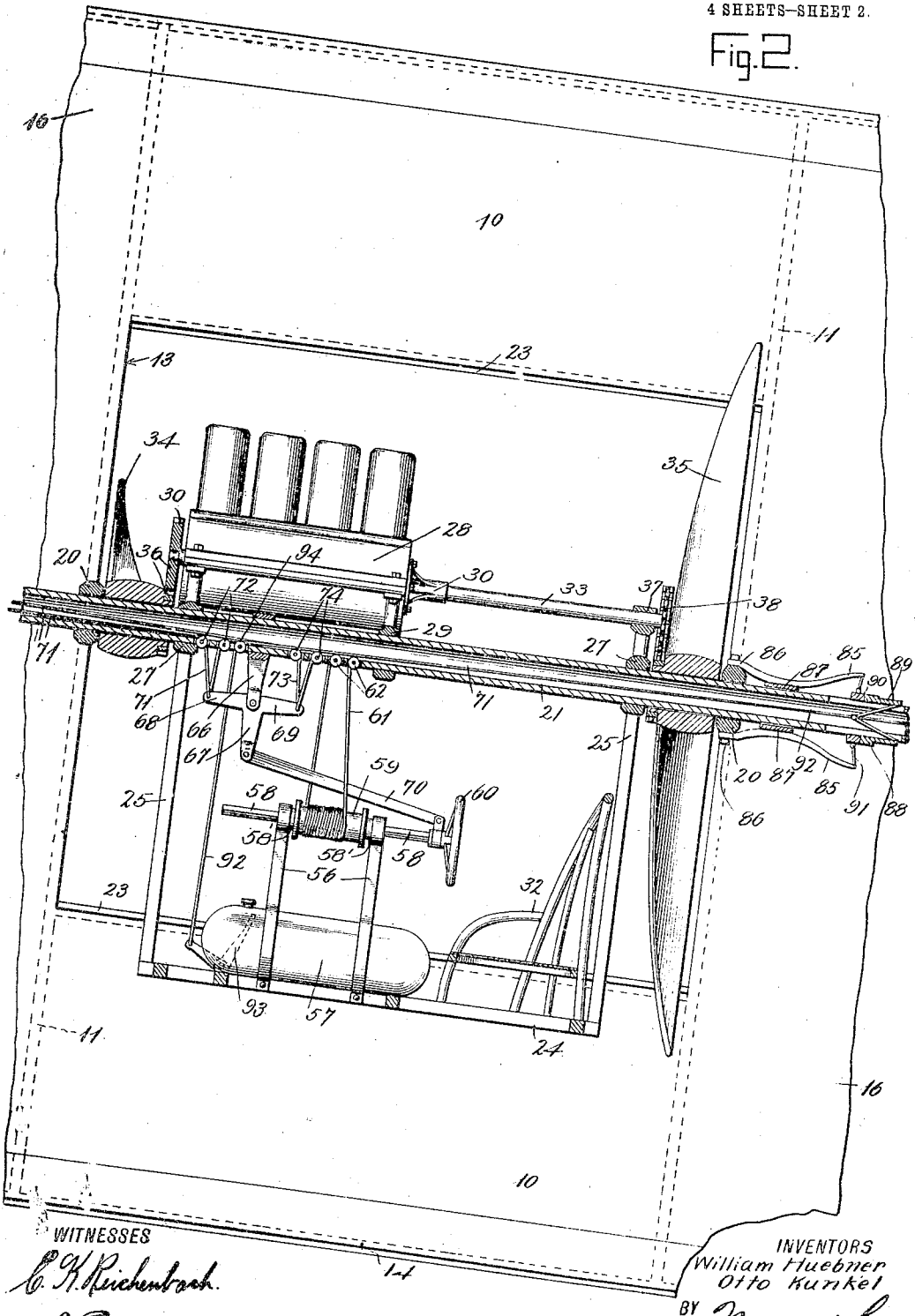
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4 SHEETS—SHEET 2.

Fig. 2.



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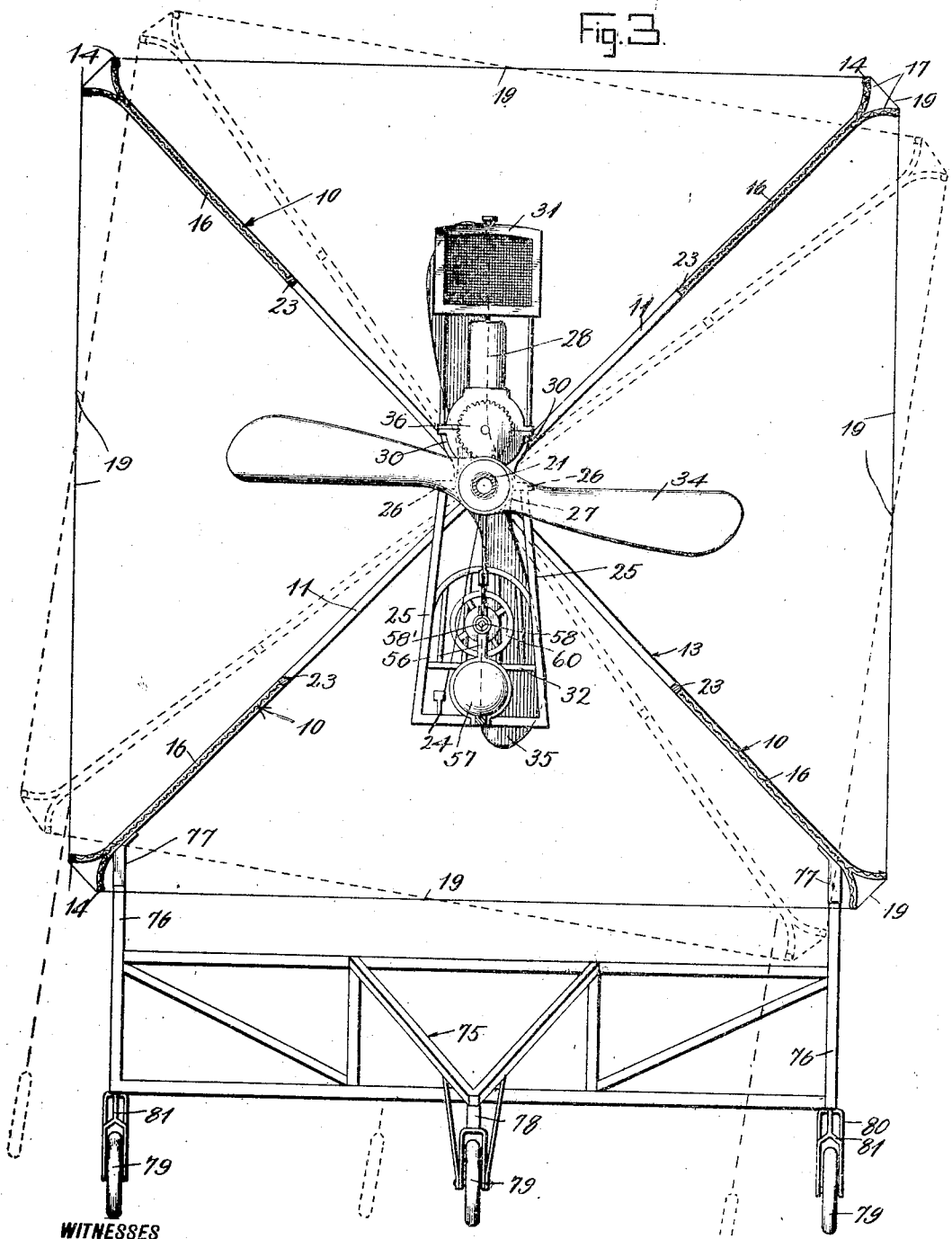
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4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

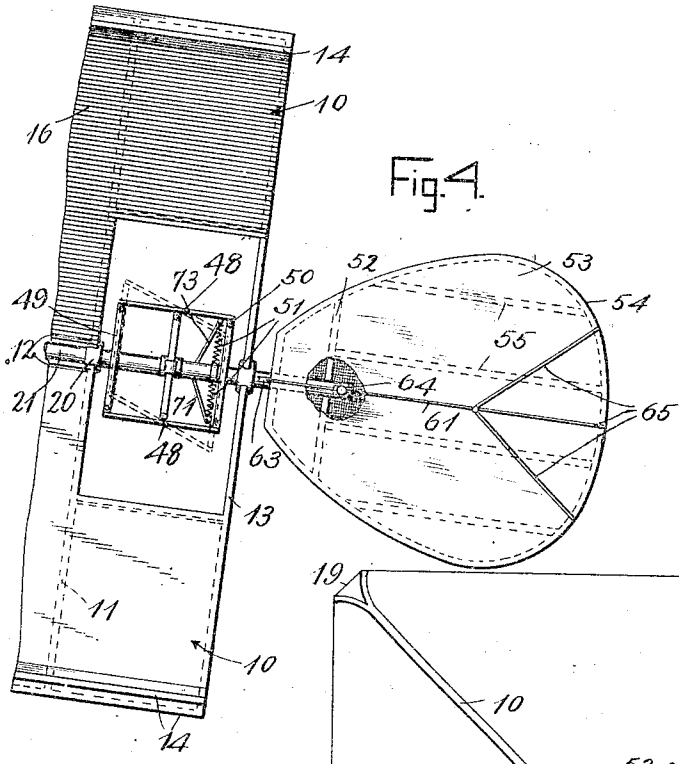


Fig. 4.

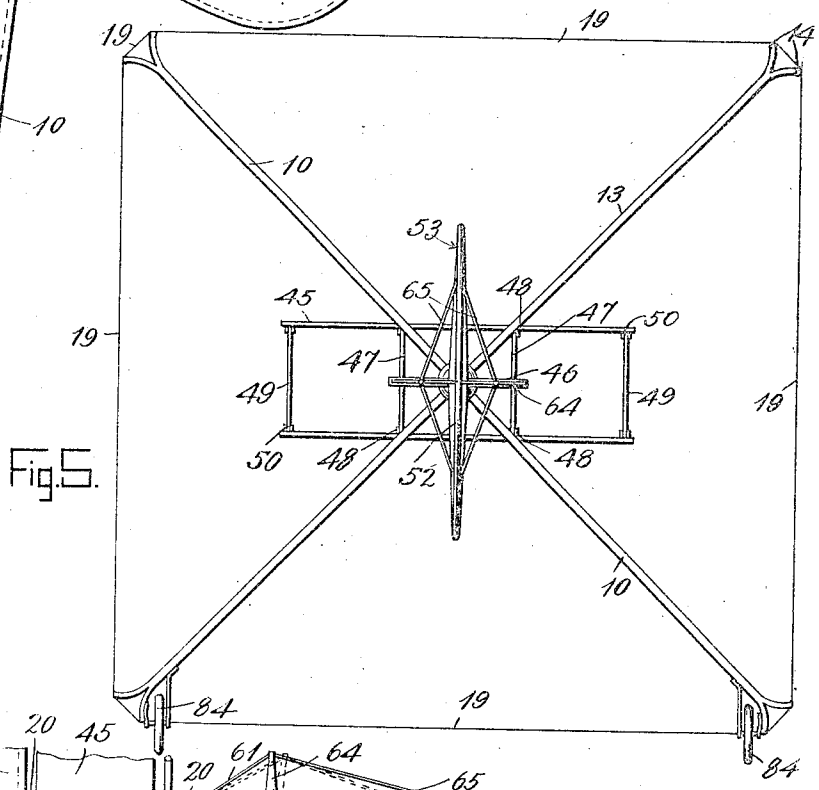


Fig. 5.

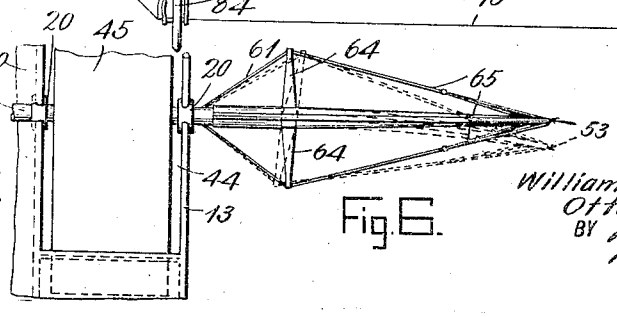


Fig. 6.

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AUTOMATIC-STABILIZING AEROPLANE.

1,131,380. Specification of Letters Patent. Patented Mar. 9, 1915.

Application filed June 6, 1913. Serial No. 772,061.

To all whom it may concern:

Be it known that we, WILLIAM HUEBNER and OTTO KUNKEL, citizens of the United States, and residents of Garfield, in the county of Bergen and State of New Jersey, have invented a new and Improved Automatic-Stabilizing Aeroplane, of which the following is a full, clear, and exact description.

This invention relates to improvements in aeroplanes or airships of the heavier-than-air type, and more particularly to an automatic stabilizing aeroplane.

The essential object of the invention is comprehended in the provision of an aeroplane of the above character in which the operating parts constituting the propelling, steering and balancing mechanisms, as well as the basket for the operator, are supported in such a manner as to permit the main or supporting planes of the machine to turn at various angles under the influence of air currents, while at the same time increasing the buoyant action of the planes, whereas the basket and working parts above referred to will remain normally dependent, and the liability of the operator losing control of the machine or being thrown from his position, will be obviated.

The invention further consists in the provision of an automatic stabilizing aeroplane, the supporting planes of which are substantially cross-shaped in cross-section and provided slightly forwardly of their longitudinal centers with openings for accommodating the supporting basket, the planes being freely revoluble but held against longitudinal displacement on a central longitudinal pivot rod or axis which carries oppositely operating propellers tending to cause the machine to travel in one direction without the usual torsioning action tending to bow the machine at a central point.

A still further object of the invention is to provide in conjunction with the supporting planes, oppositely operating elevators which are carried by the supporting rod or axis at the forward and rear extremities of the machine so as to cause the descent or ascent of the latter, the rear elevator being located within the area of the supporting planes and so mounted as to economize in space without losing the supporting action of the planes to any appreciable degree, while a flexible rudder is carried at the rear end of the rod for steering the machine to the right or left, the rod being of hollow formation so as to movably receive the operating cables controlling the movements of the elevators and rudder.

With the above and other objects in view, the invention resides more particularly in the peculiar combination and arrangement of parts which will be illustrated as a preferred embodiment in the accompanying drawings and described in the specification.

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

Figure 1 is a side elevation of our improved automatic stabilizing aeroplane, the elevators being shown in dotted lines in positions for causing the ascent of the machine; Fig. 2 is an enlarged sectional view through a central fragmentary portion of the machine to more particularly illustrate the mounting of the motor, propellers and working parts carried by the supporting basket for the operator, including means for locking the supporting planes to the rod on which the same are supported so as to prevent independent movement of either; Fig. 3 is an enlarged vertical sectional view of the device forwardly of the propellers and supporting truck, the planes and truck being indicated in dotted lines as shifted in an angular direction independently of and with respect to the supporting basket and rod carrying the latter; Fig. 4 is an enlarged elevation of a fragmentary portion of the rear ends of the supporting planes, together with the rear elevator and rudder, the elevator being indicated in dotted lines in a shifted position opposite to that illustrated in Fig. 1, for causing the descent of the machine, and the rudder being partly broken away; Fig. 5 is a rear elevation of the machine with the supporting truck and adjacent forward parts removed or omitted; Fig. 6 is a fragmentary plan view of the structure shown in Fig. 4 to more particularly illustrate the flexing or warping of the rudder; and Fig. 7 is a detail front elevation of the front elevator together with a fragmentary portion of the rod or axis and front portions of the supporting planes.

In the illustrated embodiment of the invention the supporting planes are indicated by the numeral 10, the same being substantially cross-shaped in cross-section and em-

bodying a plurality of frames 11, four in number, and constructed of longitudinal frame sections 12 and radial or transverse sections 13 connecting the same to edge portions 14 which are tapered to an apex at their forward end as shown at 15, by bending the same into form. The extremities of the planes each are provided with the usual cloth coverings 16, considered with respect to their radial extent, and are provided with forked portions 17 producing web surfaces rearwardly of the point indicated by the numeral 18, where the longitudinal edge portions 14 are bent or converged to a common point, thus providing increased supporting surface for the planes as well as serving to divide the currents to increase the buoyant properties of the planes. The edge portions of the planes are connected by transverse guy wires 19, certain of which are also diagonally extended and disposed in such manner as to connect the spaced edge portions of the planes forming the forked extremities 17, thus rendering the structure more rigid.

The radial sections or struts 13 are connected at their intersecting points by means of sleeves 20 which are freely rotatable on a hollow pivot rod or axis 21, such rod or axis extending longitudinally of the machine and projecting a short distance forwardly and rearwardly of the supporting planes. The forward extremities of the edge sections or struts of the planes are joined to a sleeve at the apex portion 15 and this sleeve abuts a ring 22 carried by the pivot rod or axis, and this structure together with the mounting of the sleeves 20 serve to prevent longitudinal shifting or displacement of the planes with respect to the pivot rod. The longitudinal sections or struts 12 also connect the sleeves 20 in close proximity to the pivot rod but slightly spaced from the latter so as to permit the planes to move freely around the rod when so directed under the action of the air currents, without disturbing the position of the rod.

Slightly forwardly of the longitudinal center of the machine or of the longitudinal sections of the supporting planes, and between closely adjacent radial sections 13, the inner portions of the planes are open and the struts are connected by longitudinal braces 23 so as to reinforce the same and also serve as an attaching means for the covering at these points. The supporting basket for the operator is indicated by the numeral 24 and embodies an open platform and spaced forward and rear suspension rods 25 which are connected to oppositely extending arms 26 of a pair of castings 27 fixed to the pivot rod so that the basket hangs normally dependent, so that its action is like that of a pendulum. A motor 28 is supported on the forward casting 27 and an intermediate casting 29 through the instrumentality of arch portions 30 suitably bolted to flanged portions of the crank case of the motor, as is more particularly illustrated in Fig. 2 of the drawings, and these flanged portions also form a support for a radiator 31 constituting a part of the cooling system of the motor. From an inspection of Fig. 3 of the drawings it will be observed that the motor is normally disposed between the upper planes and the basket is disposed between the two lower planes. Thus the channel provided at the upper part will serve to permit efficient cooling of the water in the radiator while the operator reposed in the seat 32 will have a clear view to determine his whereabouts forwardly and through the openings at the sides.

The drive shaft of the motor is indicated by the numeral 33 and at its forward end is operatively connected to the forwardmost of a pair of oppositely rotating propellers 34 and 35, as by intermeshed gears 36. These propellers are rotatably journaled on the pivot rod or axis within the area of the openings and beyond the extremities of the basket, the latter being made slightly shorter than the lengths of the openings so as to accommodate the propellers. The shaft 33 is extended rearwardly and journaled in a bearing 37 forming a part of the rear casting 27 and located above the pivot rod, the drive in this instance being through suitable sprocket wheels and a chain 38 connecting the shaft and hub of the propeller 35, in contra-distinction to the gearing arrangement for driving the propeller 34.

Carried by the forward extremity of the pivot rod 21 is an oppositely extending transverse pivot 39 which forms a pivotal support for the forward elevator 40, such elevator being in the form of a biplane having a rigid frame structure. The frame of the elevator 40 is provided at equi-distantly spaced points from its ends with cross frames 41 having hub portions 42 pivotally mounted on the transverse pivot 39 but normally held with its planes in horizontal positions by means of counter-balancing coiled springs 43 connecting the forward portions of the elevator centrally with the extremity of the rod or axis of the machine. The elevator 40 is, by reason of its attachment to the pivot rod 39, which latter is fixed to the rod or axis 21, movable with the latter but owing to the fact that the basket, working parts and operator carried thereby, will hold the basket normally dependent and the rod or axis in one position, it will be seen that the equilibrium of the elevator will be controlled automatically and that said elevator will be maintained in a horizontal position.

The main supporting planes at their rear ends are provided with openings 44 commu-

nicating with the main pivot rod or axis and restricted by the radial sections of the frame located at this point so as to accommodate the rear elevator 45. In order to mount this elevator the rod 21 is provided with a cross arm 46 carrying at its extremities vertical supports 47 extending above and below the cross arm and having pivoted to their upper and lower extremities, as shown at 48, transverse members of the elevator frame at the intermediate points. The uprights 49 of the rear elevator are also pivoted to the extremities of said frame members, as shown at 50, so that the upper and lower planes of the elevator, which is in the form of a biplane, operate on the pivots 48, while the uprights and transverse frame members operate on the pivots 50 as the elevator is shifted in causing the ascent or descent of the machine, the planes of the elevator remaining parallel at all times. This structure is provided in order to support the elevator 45 on a minimum amount of space, thus permitting the openings 44 to be made of a minimum size, whereby the supporting area of the main supporting planes, and consequently the degree of efficiency thereof, is not materially detracted from. Counter-balancing or co-acting springs 51 connect the top and bottom frames of the rear elevator 45 with the rod or axis 21 and serve to maintain the planes in horizontal positions, their operation being the same as that of the springs 43.

Fixed to the rear extremity of the rod or axis 21 and extending above and below the same is an upright 52, the same forming an attaching means for a flexible rudder 53, practically fan-shaped as shown. This rudder embodies a flexible frame 54 having its reduced end extended forwardly of the upright 52 and attached to the rod 21, while flexible longitudinal ribs 55 are provided beneath the covering of the rudder to maintain the rudder in a rectilinear position. This rudder is for steering the machine to the right or left and is located rearwardly of the main supporting planes, as shown.

For the purpose of operating the elevators and rudder, spaced bearing brackets 56 are vertically carried centrally of the supporting basket with respect to its transverse dimension and in front of the seat 32, the said bearing brackets serving to secure the gasolene supply tank 57 in position. The upper ends of the brackets have journaled therein through the medium of sleeves 58′ a squared horizontal steering shaft or post 58 which is slidable through a drum 59 located between the brackets, the shaft being adapted to slide independently of the drum but to cause simultaneous rotation of the drum therewith, while an operating wheel 60 is located at the rear end of the shaft. A cable 61 is wound upon the drum 59 intermediate its ends, and the ends of the cable are then extended upwardly and over guide pulleys 62 carried by the rod or axis 21 and then extended through the rod or axis and in opposite directions around the guide pulleys 63 mounted in diametrically opposite slots in the hollow rod adjacent the front end of the rudder. A cross rod 64 is pivoted to the rear extremity of the rod 21 and has the extremities of the cable 61 attached to the extremities of these arms, such points of the arms being then connected to the rear edge of the rudder by a plurality of strands 65. By this construction and owing to the fact that the rudder is flexible, it will be seen that by rotating the hand wheel 60, together with the drum 59, the extremities or loops of the cable 61 will be alternately wound and unwound, depending upon the direction of rotation of the wheel, whereoy the rudder may be flexed in either direction thereby causing the machine to be effectually directed in an angular course to the right or left.

Suspended by the rod 21 is a hanger 66, preferably beneath the motor and directly above the steering shaft 58, the said hanger pivotally supporting a three-armed lever having a depending arm 67, a forwardly extending arm 68 and a rearwardly extending arm 69. The depending arm 67 is pivotally connected to the hand wheel and shaft 58 by a coupling rod 70, the drum being held against longitudinal displacement between the bearing brackets and the shaft being squared so as to slide forwardly through the drum. A cable 71 is attached to the free extremity of the forwardly extending arm 68, intermediate of its ends, and such ends are extended over guide pulleys 72 rotatably journaled in slots in the rod 21 in a manner similar to the guide pulleys 62, such extremities being then extended in opposite directions through the rod, the forwardly extending portion extending through the rod near the tips of the main supporting planes and connected to the front portion of the upper plane of the front elevator centrally, while the rearwardly extending portion is also disposed through the rod and extends through the latter at its bottom portion within the area of the rear elevator at a central point. A cable 73 is connected to the rearwardly extending arm 69 and after passing over guide pulleys 74 extends in opposite directions through the rod, the extremities being passed through slots in the latter and connected to the lower portion of the front elevator and the top portion of the rear elevator. By this construction, when the steering shaft is moved forwardly the three-armed lever is caused to rock on its pivot so as to raise the arm 68 and lower the arm 69, whereby the oppositely acting cables will dip the forward

elevator and raise the rear elevator, whereby the machine is caused to ascend. Opposite movement of the lever will lower the arm 68 and raise the arm 69 to exert opposite pull upon the respective cables so as to elevate the forward elevating plane and dip the rear elevator to cause the machine to descend.

During the travel of the machine, the pendant basket with its weight will maintain the equilibrium of the elevators and rudder, as well as that of the operator, but owing to the fact that the air currents will strike the main supporting planes at different angles, especially during the travel of the machine in one direction, with a change in the direction of the air currents the normal tendency would be to cause the machine to swerve or turn to one side, were the planes fixed to the supporting rod and operating mechanism. However, owing to the fact that the supporting planes will freely turn on the supporting rod or axis, changes in the direction of air currents will cause the main planes to turn in the direction of the currents or wind, without disturbing the equilibrium of the operator and parts supported by the pivot rod. By this means the supporting planes may turn to true horizontal or vertical positions from their normal positions of 45° from the horizontal or vertical, and the buoyant properties of the planes in the currents traveling in such directions will be increased and impediment to the advancement of the machine obviated. The supporting planes will, however, be normally maintained or returned to positions at angles of 45° from the horizontal or vertical by means of a pendant supporting truck 75 located beneath the frame at the point of location of the basket. This frame includes a plurality of struts suitably connected and is of triangular form in plan, there being four vertical struts 76 which are secured in sockets 77 carried by certain of the radial sections of the supporting planes. The apex or tapered front portion of the truck is provided with a casing 78 having a fork in which is journaled a ground wheel 79, and the rear side portions of the truck have depending forks 80 in which auxiliary forks 81 are pivoted, the said auxiliary forks being connected to the frame by shock-absorbing springs 82 and in turn having ground wheels 83 journaled therein. Ground wheels 84 are journaled at the rear extremities of the lower planes inwardly of the latter, and these ground wheels coöperate with the wheeled truck during the ascent and descent of the machine, while the latter is traveling over the ground.

In order to anchor the supporting planes with respect to the hollow pivot rod or axis whereby the planes will be prevented from moving independently of the rod and parts carried by the latter, a plurality of brake levers 85 are secured, as shown at 86, to the sleeve 20 located at the rear of the openings in which the basket is located, said levers carrying intermediate brake shoes 87 operating against the peripheral face of the rod 21. A shifting ring 88 is slidably held on the rod 21 against rotation independently thereof and has rearwardly extending arms 89 located at opposite sides of the rod, while the free extremities of the resilient brake lever 85, which tend to normally hold the shoes 87 out of contact with the rod 21, are connected to a brake ring 90 by flexible connections 91, and this ring is adapted to be forced toward the brake shoes for the purpose of causing the arms to be drawn inward to exert the friction between the shoes and the rod. For this purpose a cable 92 is connected to one arm of a bell crank foot lever 93 pivoted on the platform of the basket, and such cable, after passing over the guide pulley 94, is extended through the bore of the rod 21 and is provided with branches connected to the rearwardly extending arms 89 at the rear extremity of the latter, whereby pressure on the foot lever will move the shifting ring longitudinally against the brake ring and draw the free extremities of the brake lever toward the rod 21, thus applying the brake shoes. The shoes will be released owing to the normal tendency of the resilient brake levers to spring outwardly, and since the shoes will not grip the rod to any appreciable degree, the supporting planes will be permitted to swing with sufficient ease to accomplish the balancing operation.

In practice, the machine will be normally supported upon the ground wheels 79 and 83, shocks being absorbed by the springs 82 in starting a flight and in alighting, while in ascending the ground wheel 79 will first leave the ground and then the wheels 83, and the machine is supported upon the ground wheels 84 until such time as the elevators have caused the machine to glide from the earth.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. The combination with elongated supporting planes extending radially from a common axis and a pivot rod longitudinally of said axis, said planes having openings adjacent to said rod, an operator's basket fixed to the rod and suspended within the area of said openings whereby the planes may swing laterally with respect to the rod and basket, a motor supported on the rod, oppositely rotatable propellers driven from the motor and rotatably journaled on the rod at the forward and rear ends of the openings, elevators at the front and rear

ends of the supporting planes, a rudder at the rear end of the rod, and means for tilting the elevators and flexing the rudder independently from the basket.

2. The combination with elongated supporting planes extending radially from a common axis and a pivot rod longitudinally of said axis, said planes having openings adjacent to said rod, an operator's basket fixed to the rod and suspended within the area of said openings whereby the planes may swing laterally with respect to the rod and basket, a motor supported on the rod, oppositely rotatable propellers driven from the motor and rotatably journaled on the rod at the forward and rear ends of the openings, elevators at the front and rear ends of the supporting planes, a rudder at the rear end of the rod, means for tilting the elevators and flexing the rudder independently from the basket, and a supporting truck arranged beneath the planes at the point of location of the propellers, said truck serving as a counter-balance for the planes.

3. The combination with elongated supporting planes extending radially from a common axis and a pivot rod longitudinally of said axis, said planes having openings adjacent to said rod, an operator's basket fixed to the rod and suspended within the area of said openings whereby the planes may swing laterally with respect to the rod and basket, a motor supported on the rod, oppositely rotatable propellers driven from the motor and rotatably journaled on the rod at the forward and rear ends of the openings, elevators at the front and rear ends of the supporting planes, a rudder at the rear end of the rod, means for tilting the elevators and flexing the rudder independently from the basket, a shock absorbing wheeled truck suspended from the main supporting planes beneath the point of location of the openings forwardly of the longitudinal center of the axis, and machine wheels at the rear end of the planes, said latter wheels being normally out of contact with the ground and caused to engage the latter upon the machine entering into its flight.

4. An aeroplane of the class described, embodying crossed supporting planes, said planes having their longitudinal edges forked to provide web surfaces, elevating means for the planes, a rudder for the same, and propelling means for the planes.

5. An aeroplane embodying crossed supporting planes having their forward extremities tapered to a substantial point and their longitudinal edges forked, the longitudinal edges of the planes being braced together, a rod longitudinally of the planes at the line of crossing of the latter to permit the planes to tilt in angular positions under the action of air currents independently of the rod, and propelling and guiding mechanism fixed to the rod to remain normally stabilized.

6. An areoplane embodying crossed supporting planes having forward extremities tapered to an apex, the longitudinal edges of the planes being braced together, a rod longitudinally of the planes at the line of crossing of the latter to permit the planes to tilt in angular positions under the action of air currents independently of the rod, an operator's support fixed to the rod, tiltable elevators also carried by the rod at opposite ends of the latter, and means including cables passing through the rod for tilting said elevators, said planes having openings accommodating the operator's support and the elevator at the stern, the elevator at the bow end being positioned forwardly of the planes.

7. An aeroplane embodying crossed supporting planes having tapered forward extremities, the longitudinal edges of the planes being braced together, a rod longitudinally of the planes at the line of crossing of the latter to permit the planes to tilt in angular positions under the action of air currents independently of the rod, an operator's support fixed to the rod, tiltable elevators also carried by the rod at opposite ends of the latter, a flexible rudder at the rear end of the rod, cables connected to the elevators and to the rudder and extended to the support, and means carried by the latter for shifting the cables to tilt the elevators and warp the rudder independently.

8. An aeroplane embodying supporting planes crossed to provide a line of crossing and having tapered forward extremities, the longitudinal edges of the planes being braced together, a rod longitudinally of the planes at the line of crossing of the latter to permit the planes to tilt in angular positions under the action of air currents independently of the rod, an operator's support fixed to the rod, tiltable elevators also carried by the rod at opposite ends of the latter, a flexible rudder at the rear end of the rod, cables connected to the elevators and to the rudder and extended to the support, and means carried by the latter for shifting the cables to tilt the elevators and warp the rudder.

9. An aeroplane embodying crossed supporting planes having tapered forward extremities, a rod longitudinally of the planes at the line of crossing of the latter to permit the planes to tilt in angular positions under the action of air currents independently of the rod, propelling and guiding mechanism fixed to the rod to remain normally stabilized, and means suspended from the main supporting planes for holding the latter stabilized and against the wind.

10. An aeroplane, embodying crossed sup-

porting planes, having tapered forward extremities, the longitudinal edges of the planes being braced together transversely and diagonally, a rod longitudinally of the planes at the line of crossing of the latter to permit the planes to tilt in angular positions under the action of air currents independently of the rod, propelling and guiding mechanism fixed to the rod and adapted to remain normally stabilized, said propelling and guiding mechanism being located at spaced points longitudinally of the machine, brake means for engaging the rod to hold the planes against movement thereon, means for operating the brake means, balancing mechanism for the aeroplane, and a common means for independently or simultaneously operating the balancing and guiding mechanism.

11. A stabilizing aeroplane including crossed main planes having radial frame portions provided with central bearing sleeves, a hollow pivot rod on which the bearing portions are turnable, said main planes being held against longitudinal displacement on the rod, portions of the planes forwardly of the longitudinal centers being removed to provide openings adjacent to the rod, a pendent frame fixed to the rod within the area of said openings, a motor carried at the top of the frame to one side of the rod, propellers journaled on the rod at the forward and rear extremities of the openings and oppositely driven by the motor, braking means carried by the rod, and means operating through the latter and connected to said braking means to be moved into operative position from the pendent frame.

12. A stabilizing aeroplane including main planes having radial frame portions provided with central bearing sleeves, a hollow pivot rod on which the bearing portions are turnable, said main planes being held against longitudinal displacement on the rod, portions of the planes forwardly of the longitudinal centers being removed to provide openings adjacent to the rod, a pendent frame fixed to the rod within the area of said openings, a motor carried at the top of the frame above the rod, propellers journaled on the rod at the forward and rear extremities of the openings and oppositely driven by the motor, a biplane-like elevator pivoted to the forward extremity of the rod, cables connected to upper and lower points of the latter and operable through the pivot rod from the pendent frame, and means for locking the main supporting planes to the rod.

13. A stabilizing aeroplane including main planes having radial frame portions provided with central bearing sleeves, a hollow pivot rod on which the bearing portions are turnable, said main planes being held against longitudinal displacement on the rod, portions of the planes forwardly of the longitudinal centers being removed to provide openings adjacent to the rod, a pendent frame fixed to the rod within the area of said openings, a motor carried at the top of the rod, propellers journaled on the rod at the forward and rear extremities of the openings and oppositely driven by the motor, a biplane-like elevator pivoted to the forward extremity of the rod, cables connected to upper and lower points of the latter and operable through the pivot rod from the pendent frame, and means for normally holding the elevator in a neutral position.

14. A stabilizing aeroplane including main planes having radial frame portions provided with central bearing sleeves, a hollow pivot rod on which the bearing sleeves are turnable, said main planes being held against longitudinal displacement on the rod, portions of the planes forwardly of the longitudinal centers being removed to provide openings adjacent to the rod, a pendent frame fixed to the rod within the area of said openings, a motor carried at the top of the frame above the rod, propellers journaled on the rod at the forward and rear extremities of the openings and oppositely driven by the motor, a biplane-like elevator pivoted to the forward extremity of the rod, cables connected to upper and lower points of the latter and operable through the pivot rod from the pendent frame, the rear portions of the main planes also having openings communicating with the rod, a biplane-like elevator embodying hinged parts pivoted to said rod to be tilted within the area of said openings, and independent springs connected to the rod and to the upper and lower portions of the elevators for holding the same in horizontal positions parallel with respect to the rod.

15. A stabilizing aeroplane including main planes having radial frame portions provided with central bearing sleeves, a hollow pivot rod on which the bearing sleeves are turnable, said main planes being held against longitudinal displacement on the rod, portions of the planes forwardly of the longitudinal centers being removed to provide openings adjacent to the rod, a pendent frame fixed to the rod within the area of said openings, a motor carried at the top of the frame, propellers journaled on the rod at the forward and rear extremities of the openings and oppositely driven by the motor, a biplane-like elevator pivoted to the forward extremity of the rod, the rear portions of the main planes also having openings communicating with the rod, a biplane-like elevator embodying hinged parts pivoted to said rod to be tilted within the area of said openings, independent springs con-

nected to the rod and to the upper and lower portions of the elevators for holding the same in horizontal positions, a fan-shaped rudder at the rear end of the rod, and independently operable cables associated with the elevators and rudder for tilting and warping the same.

16. The combination with a main supporting plane and a hollow rod on which said supporting plane is rotatably mounted against longitudinal displacement, said plane having openings intermediate its ends and an operator's basket suspended within said openings; of oppositely tiltable elevators near the front and rear ends of the plane, a rudder also carried by the rod for directing the plane in angular directions to the right or left, cables connected to each elevator and to the rudder and passed longitudinally through the rod, a lever pivotally suspended upon the rod and having oppositely operable arms to which the cables of each elevator are connected, and means for moving the lever on its pivot, said means including a slidably supported shaft having connection with the lever whereby when the shaft is shifted the lever will be moved on its pivot and a drum mounted on the shaft to turn therewith but constrained to translate and shift with the shaft, said rudder cable being wound around the drum so that the ends thereof will be oppositely shifted upon the drum being rotated.

17. The combination with a main supporting plane and a hollow rod on which said supporting plane is rotatably mounted against longitudinal displacement, said plane having openings intermediate its ends and an operator's basket suspended within said openings; of oppositely tiltable elevators near the front and rear ends of the plane, a rudder also carried by the rod for directing the plane in angular directions to the right or left, cables connected to each elevator and to the rudder and passed longitudinally through the rod a lever pivotally suspended upon the rod and having oppositely operable arms to which the cables of each elevator are connected, means for moving the lever on the pivot, said means including a shaft supported for translatory movement and connected to the lever, and a drum mounted on the shaft to permit the latter to be translated independent thereof but adapted to rotate therewith, said drum having the rudder cable wound thereon, brake arms mounted on the plane and having shoes for engaging the periphery of the rod but held out of contact therewith, a cable connected to each arm at its free extremity, a shifting ring movable on the rod to which said cables are connected, a brake ring also movable on the rod, cables connected to the latter ring, said last named cables being passed through the rod, and a foot lever carried by the basket and connected to the latter cables for causing the engagement of the shoes with the rod.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM HUEBNER.
OTTO KUNKEL.

Witnesses:
LOUIS HUEBNER,
ADOLPH E. KUNKEL.

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