N. E. BROWN.

GYROPLANE.

APPLICATION FILED AUG. 3, 1911.

1,040,136.

Patented Oct. 1, 1912.

6 SHEETS—SHEET 1.

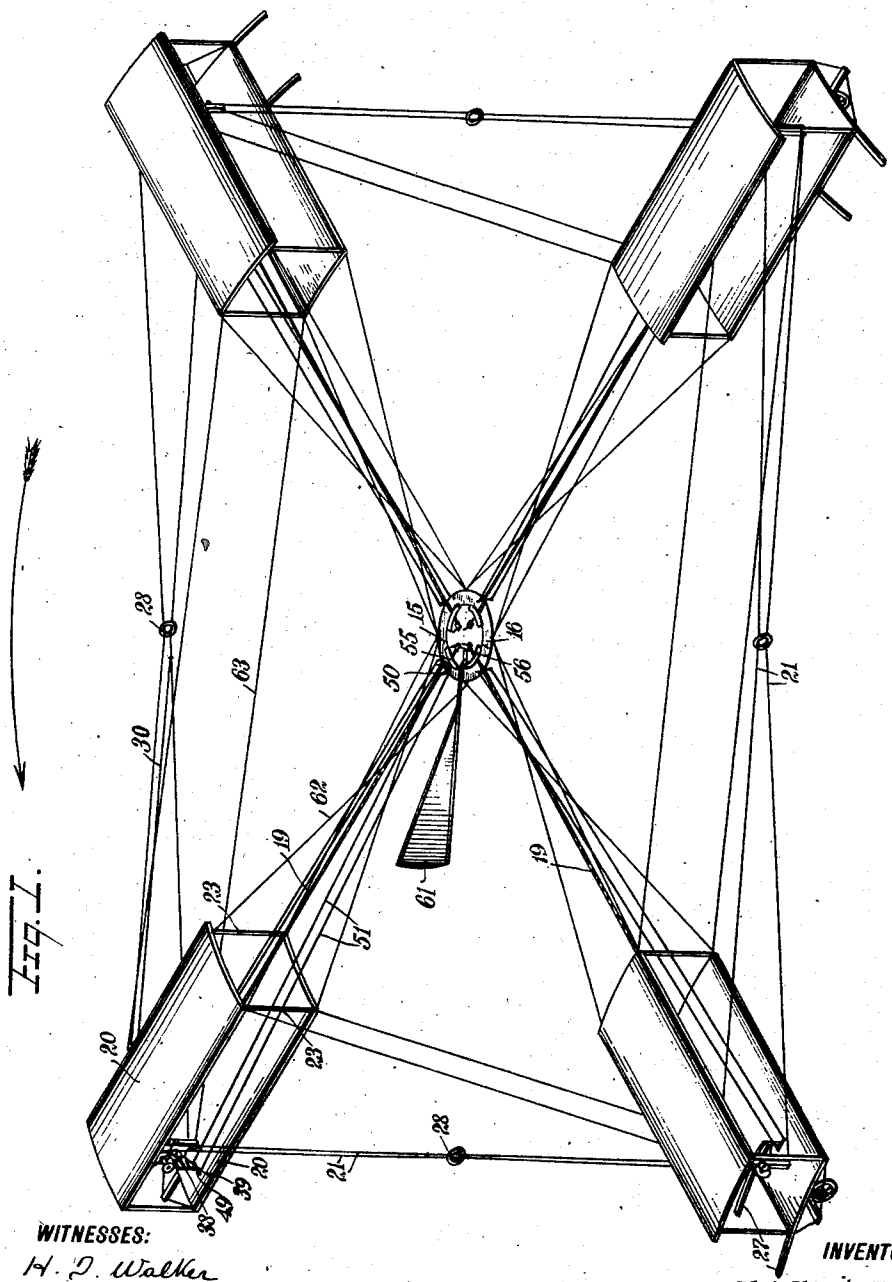

Fig. 1.

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6 SHEETS—SHEET 2.

Fig. 2.

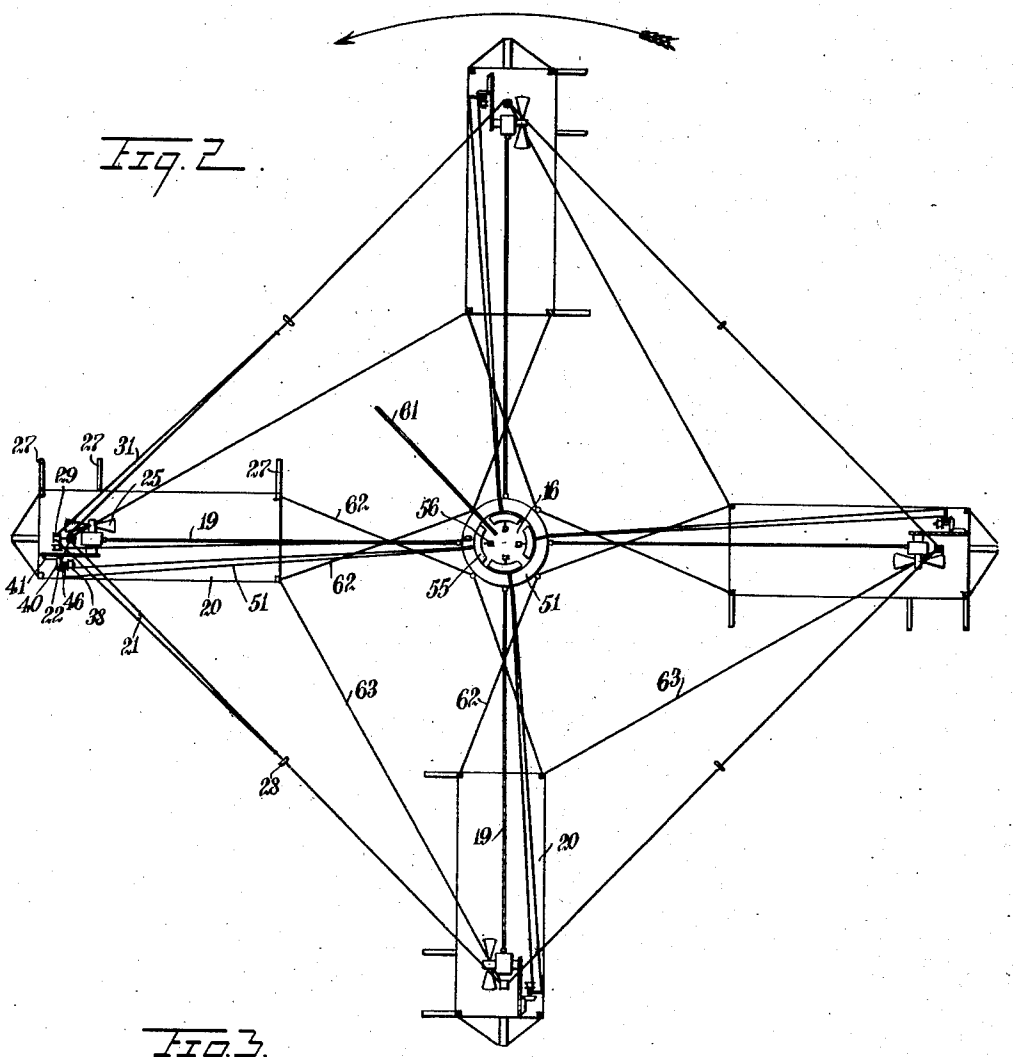
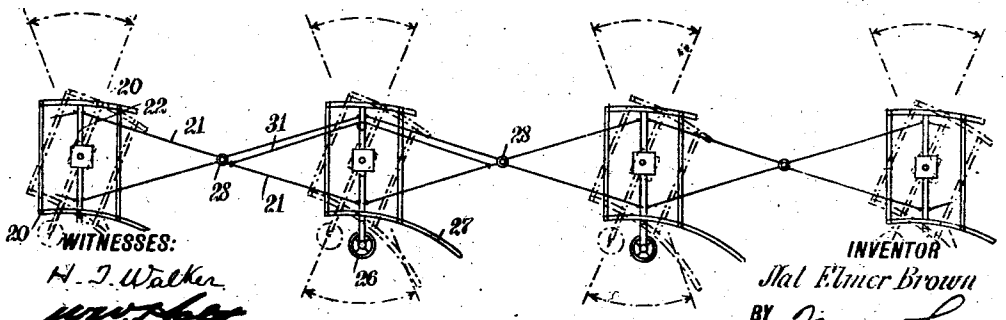


Fig. 3.



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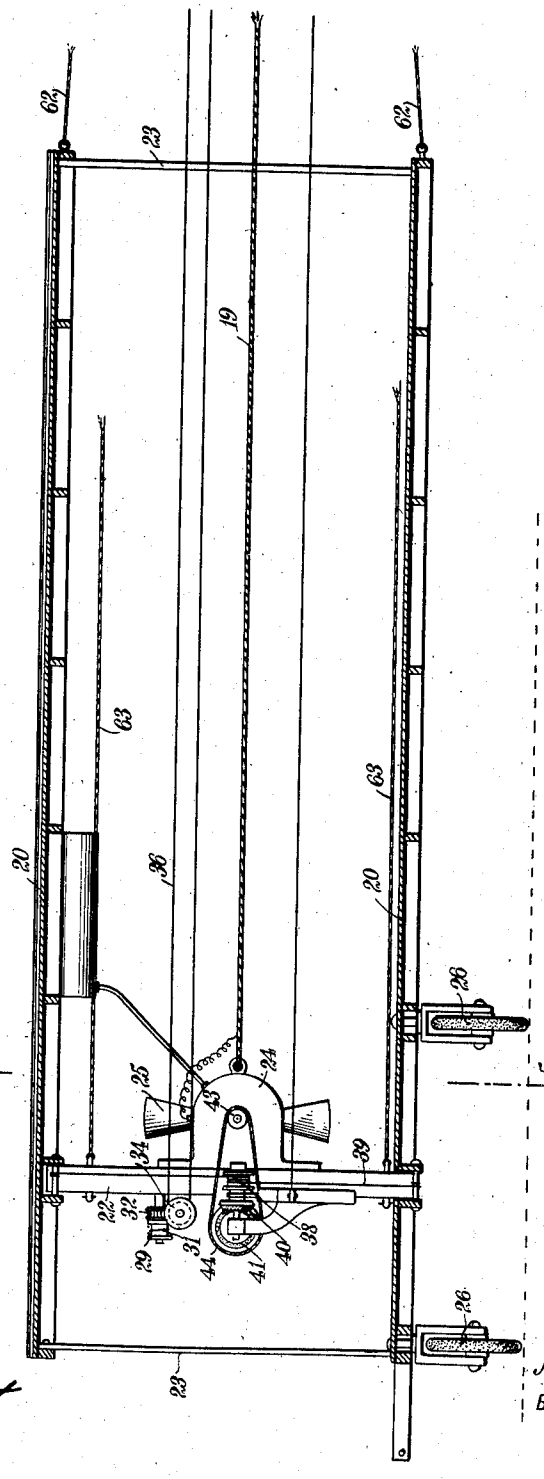
6 SHEETS—SHEET 3.

Fig. 3.



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6 SHEETS—SHEET 4.

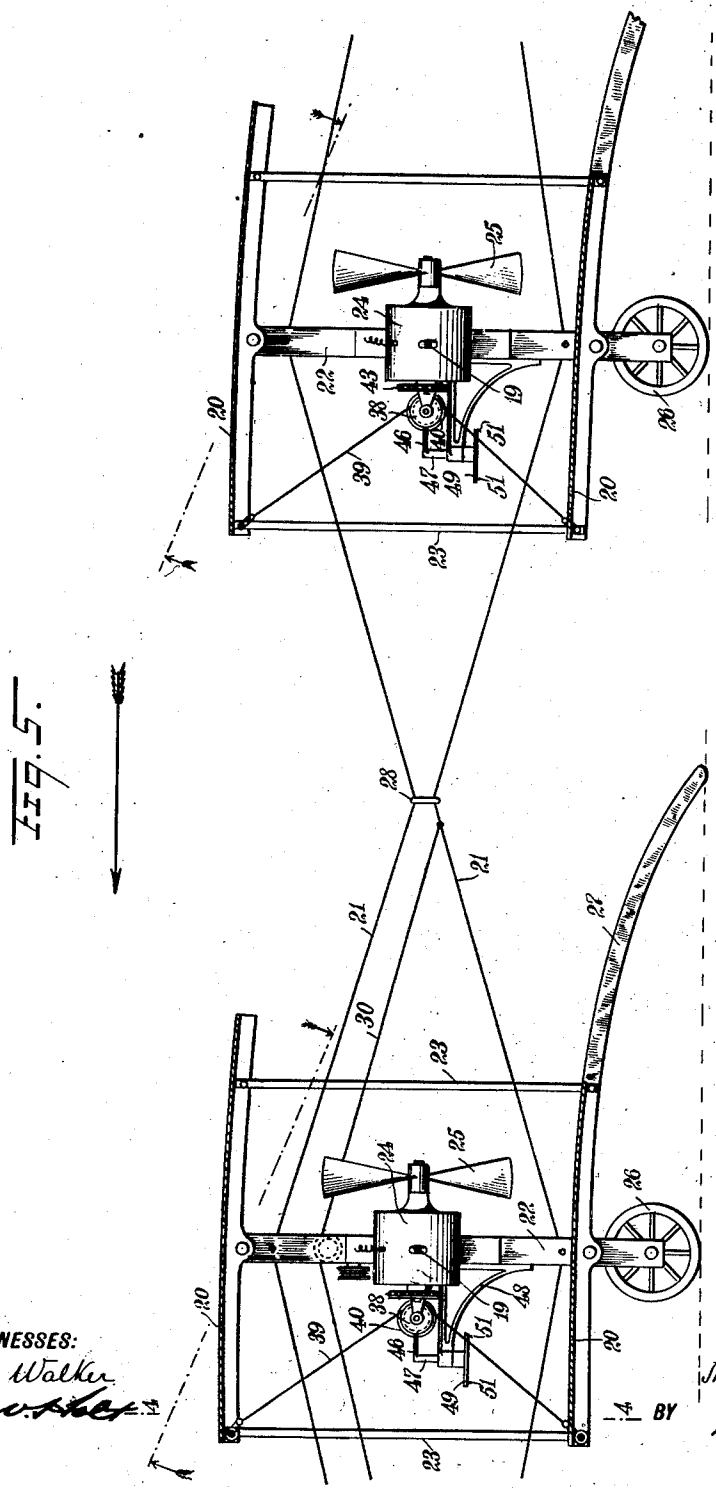

Fig. 5.

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6 SHEETS—SHEET 5.

Fig. 6

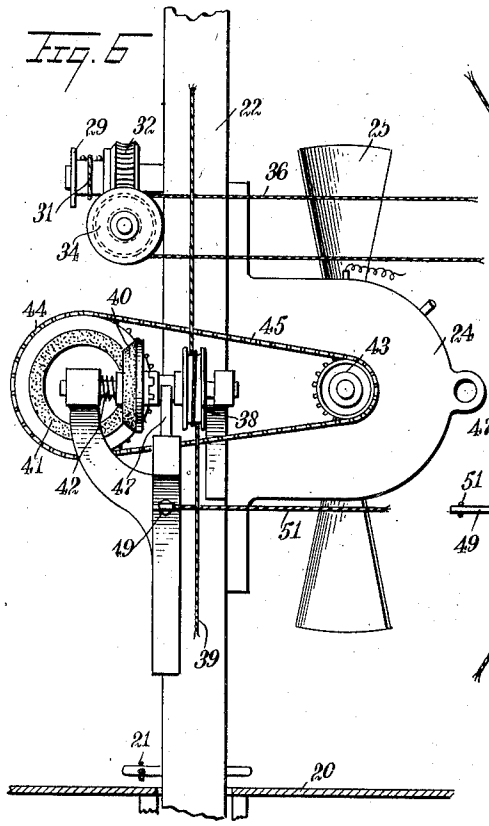


Fig. 7.

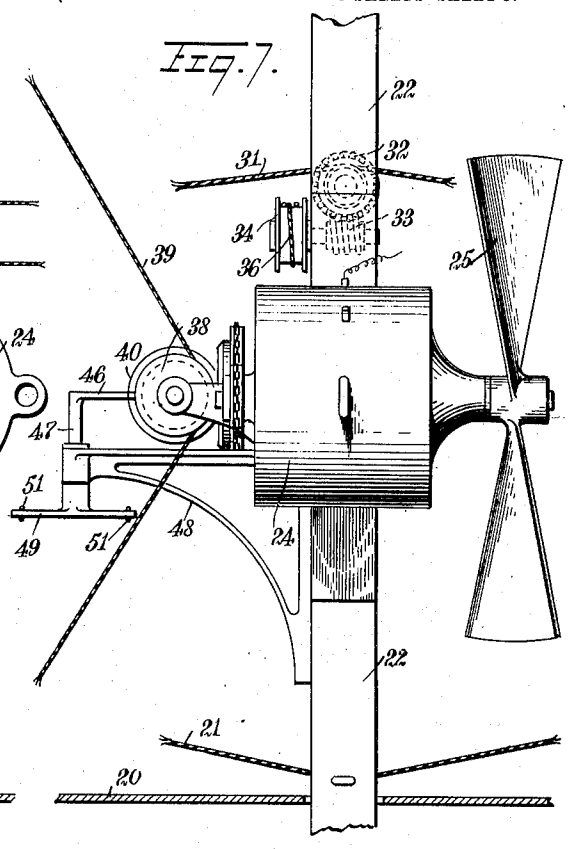
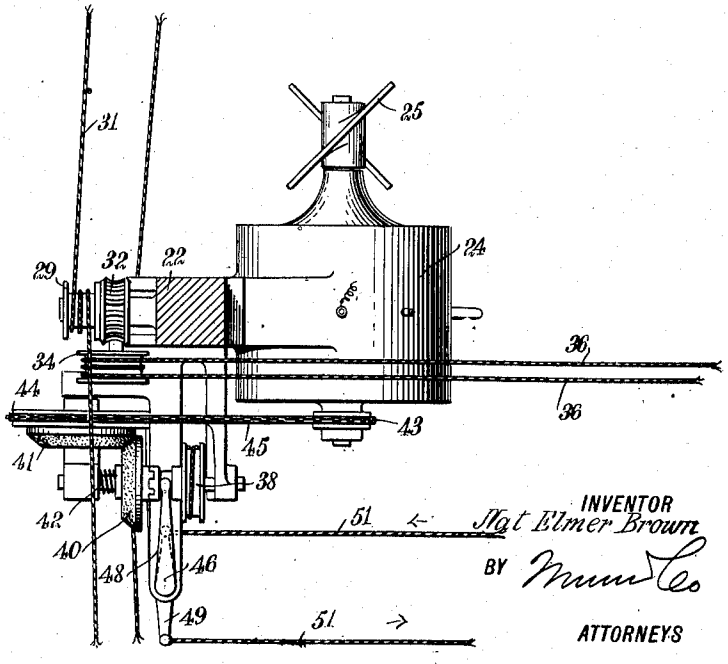


Fig. 8.



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3 SHEETS—SHEET 3.

Fig. 9.

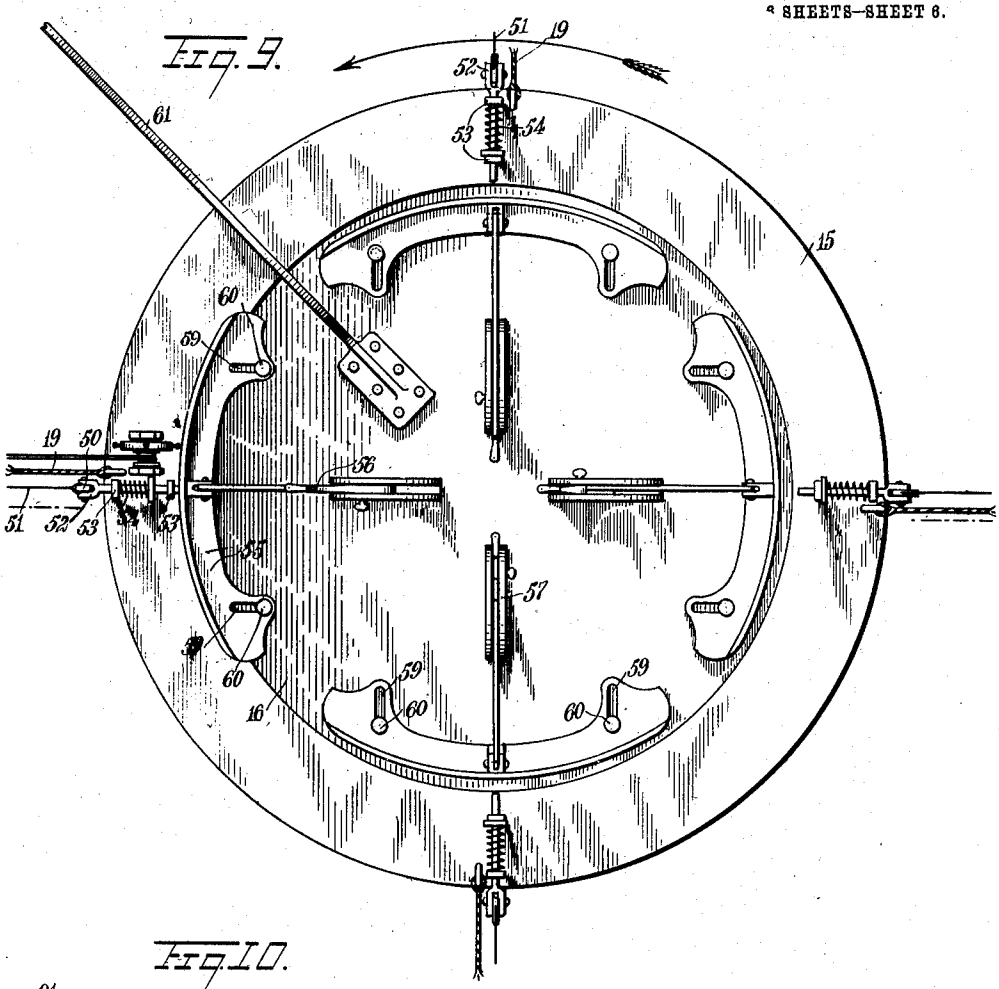
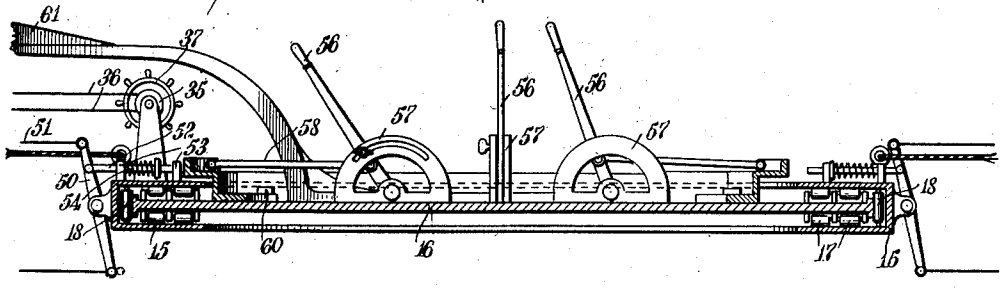


Fig. 10.



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UNITED STATES PATENT OFFICE.

NAT ELMER BROWN, OF GRAND HAVEN, MICHIGAN.

GYROPLANE.

1,040,136. Specification of Letters Patent. Patented Oct. 1, 1912.

Application filed August 3, 1911. Serial No. 642,176.

To all whom it may concern:

Be it known that I, NAT ELMER BROWN, a citizen of the United States, and a resident of Grand Haven, in the county of Ottawa and State of Michigan, have invented a new and Improved Gyroplane, of which the following is a full, clear, and exact description.

The invention is an aeroplane, which I preferably term a "gyroplane," this name being appropriate by reason of the analogy which the machine bears in action to the gyroscope.

The invention contemplates a revoluble aeroplane adapted to ascend or descend vertically, either in a horizontal or inclined path, the machine having at the center a nonrevoluble support or platform for the aviator, from which platform the planes radiate and are connected preferably flexibly, the planes and their respective engines and other parts of weight in motion, exerting an outward pull from the center of the machine by reason of the centrifugal force developed, and in this manner operating to keep the machine stretched and in equilibrium, provision being made for controlling the angle of all the planes from the aviator's position, and for succesively tilting the planes as they pass a particular point, so as to throw one side of the machine higher than the opposite side, whereby the machine glides in the direction of the low side.

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.

Figure 1 is a perspective view of an aeroplane constructed in accordance with my invention, the machine being shown as when in flight; Fig. 2 is a plan of the machine, partly in horizontal section; Fig. 3 is a diagrammatic view, illustrating the mode of simultaneously tilting the planes; Fig. 4 is a vertical longitudinal section on the line 4—4 of Fig. 5, through one of the planes; Fig. 5 is a sectional view on the line 5—5 of Fig. 4, illustrating the connection between two adjacent planes; Fig. 6 is a fragmentary sectional view showing the motor mechanism in front elevation; Fig. 7 is a corresponding sectional view, showing the motor and adjacent mechanism in side elevation; Fig. 8 is a horizontal section, showing the motor and adjacent mechanism in plan; Fig. 9 is a plan of the aviator's platform and surrounding revoluble ring; and Fig. 10 is a central vertical section through the platform and ring.

In the construction of the gyroplane, a bearing ring 15 is revolubly arranged about a platform 16, for the aviator, this platform being of suitable extent and located at the center of the machine. The connection between the platform and bearing ring is preferably effected as shown in Fig. 10, wherein it will be seen that the ring is internally grooved and receives the peripheral portion of the platform, between which portion of the platform and the ring at both the upper and lower side are provided bearing rollers 17, similar bearings 18 being located between the ring and periphery of the platform, this manner of assembling the platform and ring obviously taking care of any thrust between these parts, either of a vertical or lateral nature. Radially arranged with respect to the platform and ring and connected to the ring through supporting cables 19, are a series of lifting planes, each preferably in the nature of a biplane comprising the upper and lower planes 20, 20, the biplanes being of any suitable number, ordinarily four, and equally spaced about the ring, in which relative position they are retained when the machine is in flight, by spacing cables 21. The planes 20 of each biplane are carried on a vertical support or post 22, the planes 20 being fulcrumed intermediate their lengths to the post 22, and are further connected together at both the front and rear, ordinarily adjacent to the corners, by links or bars 23, these bars maintaining the planes in substantial parallelism. The support or post 22 of each biplane carries a motor 24, which is positioned ordinarily equi-distant between the bottom and top planes 20, and carries on its driving shaft at the rear, a propeller 25. Each biplane is provided with supporting wheels 26, which are arranged so that the biplane will be substantially balanced when the plane is resting on the ground, the weight of the plane at the rear of the post slightly preponderating so that this portion of the plane will be supported from the ground by legs or arms 27, which are attached to the bottom plane 20.

The supporting cables 19 are shown to be attached to the motor casings, which points of connection are at or near the centers of

gravity of the respective planes; and the spacing cables 21 are connected to the posts 22 respectively adjacent to the bottom and top planes 20, these cables being also connected at points intermediate the planes, by bridle rings 28, which hold the upper and lower cables relatively close together. For tilting all of the planes simultaneously in controlling the vertical travel of the machine, a drum 29 is suitably revolubly supported on the posts 22 of one of the planes at one side of the motor, preferably above the motor as shown, and receives a cable 30, which is passed thereabout one or more times and connected to the spacing cable 21, adjacent to the rings 28, each drum being rigid with a worm-wheel 32, which is in mesh with a worm 33, having a relatively fixed drum 34, the latter being operatively connected to a drum 35 by a cable 36. The drum 35 is suitably supported on the ring 15, and is operated by a hand-wheel or equivalent actuating member 37. By turning the hand-wheel in one direction it will be seen that the drum 29 is caused to revolve by reason of the intermediate connecting mechanism and haul on one side of the cable 31 and pays out the cable on the opposite side, thus pulling the cable 21, to which the cable 31 is attached, to one side and causing the several planes to assume a laterally-inclined position, the direction of this inclination depending upon the direction of rotation of the hand-wheel 37. If the planes are to be tilted in a direction for the machine to ascend, which is ordinarly the only inclination desired, they are inclined downwardly and rearwardly, as indicated in dotted outline in Figs. 3 and 5. It is unnecessary to provide more than one tilting cable 31, since the tilting movement given to one plane is imparted to all of the planes of the series, through the spacing cables 21.

To successively and independently tilt the planes as they pass a common point, and in this manner cause one side of the machine to rise higher than the opposite side, whereby the machine starts to glidingly travel in the direction of the low side, for each plane a drum 38 is revolubly supported on its post 22, and receives a cable 39, the ends of which are attached adjacent to the corresponding edges of the top and bottom planes 20, in the present instance shown to be at the front of the plane, the drum being shown positioned at or near the level of the motor and relatively close into the post. To the shaft on which the drum 38 is secured is slidably splined a bevel friction wheel 40, which is arranged to engage a similar friction wheel 41, but normally forced therefrom by a spring 42, the friction wheel 41 being suitably driven from the motor, as by the sprocket wheels 43 and 44, and the connecting chain 45, the sprocket wheel 43 being shown to be secured to the driving shaft of the motor at the front, and the sprocket wheel 44 rigid with the friction wheel 41. An arm 46 is carried on a vertical shaft 47, which is journaled in a bracket 48, attached to the post 22, and engages at its inner end behind the friction wheel 40. The vertical shaft 47 has also attached a cross arm or lever 49, which is operatively connected to a corresponding cross-arm or lever 50, adjacent to the ends, by cables or lines 51. The cross-arm or lever 50 is fulcrumed to the ring 15, ordinarily to swing in a vertical plane, and at an intermediate point is provided with a bolt 52, slidable through guides 53, fixed to the ring 15, and normally forced inwardly under the influence of a spring 54. On the aviator's platform are arranged a number of cams 55, each of which is advanceable and retractable independently of the others, by a lever 56, the levers traversing suitable locking arcs 57, and operatively connected to the cams by links 58. The cams 55 are each slidably supported on the platform and are offset near the top, as shown in Fig. 10, to project over the ring 15, the connection between the platform and cams being suitably effected, as by providing the cams with a number of slots 59, through which bolts 60 extending into the platform pass. From this construction it is apparent that upon advancing one of the cams through its operating lever, the spring-pressed bolts 52 as they pass thereon are projected, causing the arm 50 through the cables 51, arm 49 and vertical shaft 47, to swing the arm 46 in a direction to force the friction wheel 40 into engagement with the friction wheel 41, which causes the revolution of the drum 38, in a direction to tilt the planes 20, by means of the cable 39, the tilting movement ordinarily being in a direction to cause this side of the machine to ascend above the opposite side.

To insure the immobility of the platform 16, in so far as revolution is concerned, when the machine is in action, the platform is provided with a relatively large rediating vane 61, vertically arranged, the vane presenting a relatively large area to the air opposed to the rotative tendency.

To brace the planes and prevent them from wabbling or swinging from a radial direction, the uprights or bars 23 at the inner corners of each plane are connected to the ring 15, by crossed bracing cables 62; and bracing cables 63, are extended from one of these bars at both the bottom and top to corresponding points of the post 22 of the adjacent plane (see Fig. 4). The supporting, spacing and bracing cables are placed under tension when the machine is in flight by reason of the centrifugal action and operate to maintain the machine symmetrical.

In the operation of the machine, the planes are each secured against advancing in rotation and the several propellers set in motion by their respective motors. The aviator then takes his position on the platform and the several planes are simultaneously released. Under the impulse of the propellers they will travel about the common center on the supporting wheels, the centrifugal force developed as the speed of the planes is accelerated drawing tighter and tighter on the central supporting cables 19. When the speed of the planes has become sufficiently great the tension on the supporting cables will lift the weight of the central platform and the aviator. The planes are now tilted to their normal inclinations, which will cause the whole machine to rise gradually upon the air. As the machine leaves the ground the aviator can cause it to rise as rapidly as the engines will lift it, or remain at a desired height by the operation of the hand wheel 37, to tilt the several planes simultaneously.

At a sufficient altitude the aviator determines the course he wishes to travel, and projects the opposite cam 55 by its operating lever 56, causing this side of the machine to climb slightly higher than the opposite side, whereby the machine glides in the direction of the low side. If the planes are so regulated that the ascendency of the machine, due to the inclination of all of the planes, is equal to the drop caused by the machine gliding in the direction of its low side, the machine travels in a horizontal path. The greater the inclination of the machine, the more rapidly it travels, the speed of the machine accordingly depending on the ability of the engines to drive the machine upwardly. If the engines were revolving as inert bodies, that is to say without any movement of the parts of the engines, the advance of the machine in the direction of its low side would not be in a straight line, but in a curve, the machine curving to that side offering the greater resistance, but as the engines are working and pulling through their propellers on the air, this effect is overcome as follows:

Suppose, for example, that the whole machine is advanced through the air at thirty miles per hour, and the rotating peripheral speed of each engine is sixty miles per hour; as the advancing side of rotation is traveling through the air at ninety miles per hour, and the receding side at only thirty miles per hour, and since the engines could not haul on the air at the rate of ninety miles per hour without an increased speed of the propellers, the engines would start to race on this side. The momentum of this racing carried to the side of slower motion through the air causes the propellers to pull harder on the thirty mile per hour side, this extra pull backward offsetting the greater resistance in the same direction, caused by the higher speed of the advancing rotating side, causing the whole machine to advance in a straight line. The manner of extending the planes or causing them to draw from the center of the machine dispenses substantially with all bracings, girders, cross-trussings, etc., which contribute heavily to head resistance. Also, by flexibly connecting the planes from the center of the machine it is possible to construct aeroplanes of this character of greatly increased sizes, and to easily transport them from one point to another, the weight of the engines in a machine of this character instead of being objectionable, at once becomes essential to the successful working, since by this weight the required centrifugal force is developed, overcoming any possibility of the machine upsetting or being affected by changing air currents.

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

1. In an aeroplane, a platform, a member mounted to revolve on the platform, a plurality of planes flexibly connected together, flexible connections between the planes and member, and independent propelling means carried by each plane.

2. In an aeroplane, a platform, a member mounted to revolve on the platform, a plurality of pivoted and wheel supported planes, flexible connections between the planes, flexible connections between the planes and the revoluble member, and independent propelling means carried by each plane.

3. In an aeroplane, a platform, a member mounted to revolve on the platform, a plurality of flexibly connected biplanes, each flexibly connected with the said member, the planes of each biplane being pivoted, propelling means in each biplane, means for tilting the biplanes simultaneously, and means for independently tilting the planes of the biplanes.

4. In an aeroplane, a platform, a revoluble member on the platform, a plurality of biplanes, each comprising oppositely arranged and pivoted planes, propelling means in each biplane, flexible means for connecting the biplanes with the revoluble member, flexible connections between the biplanes, and means connected with the biplanes and with the connections between the biplanes and operated from the platform for simultaneously tilting all the biplanes.

5. In an aeroplane, a platform, a revoluble member on the platform, a plurality of flexibly connected biplanes, each comprising oppositely arranged and pivoted planes, propelling means in each biplane, flexible means connecting the biplanes with the revoluble

member, and means connected with the planes of each biplane and controlled from the platform for tilting the said planes.

6. In an aeroplane, a platform, a plurality of biplanes, each comprising oppositely arranged and pivoted planes, a motor in each biplane, a propeller operated by each motor, means connecting the biplanes with the platform, cables connected with the planes of each biplane, and means controlled from the platform for operating the cables from the motor to tilt the planes.

7. In an aeroplane, a series of planes revoluble about a common axis, each plane having an upper and lower plane and an intermediate connecting support, and spacing cables extending between the upper and lower ends of adjacent supports of the planes and having an intermediate bridle through which they are slidable.

8. In an aeroplane, a series of biplanes revoluble about a common axis, the planes of the biplanes having an intermediate support, to which they are pivotally connected, and means to successively tilt the planes of each biplane on their respective supports as the biplanes pass a prescribed point.

9. In an aeroplane, an aviator's support, a member revoluble on the support, a series of biplanes flexibly connected to the member and revoluble about the said support, spacing cables arranged between the biplanes, and means to tilt the planes, having a cable connected to the spacing cables.

10. In an aeroplane, an aviator's support, a member revolubly arranged on the support, a series of biplanes flexibly connected to the member, each biplane having a post to which its planes are fulcrumed, and means to independently tilt the planes of each biplane, having a cable operatively connecting the planes of each biplane together.

11. In an aeroplane, a series of gyral biplanes, spacing cables connecting the planes together, the planes of each biplane pivotally supported to swing in unison, means to simultaneously tilt the biplanes, operatively connected to the spacing cables, and means to tilt successively the planes of each biplane on their respective pivots.

12. In an aeroplane, a central platform, a ring revoluble on the platform, a series of gyral planes flexibly connected to the ring, spacing cables extending between the planes, and bracing cables extending between the planes and ring.

13. In an aeroplane, a central platform, a ring revoluble on the platform, a series of gyral planes operatively and flexibly connected to the ring, spacing cables extending between the planes, and bracing cables extending between the inner portion of one plane and the outer portion of an adjacent plane.

14. In an aeroplane, a central platform, a ring revoluble on the platform, a series of gyral planes operatively and flexibly connected to the ring, spacing cables extending between the planes, bracing cables extending between the inner portion of one plane and the outer portion of an adjacent plane, and crossed bracing cables connecting each plane with the ring.

15. In an aeroplane, a series of biplanes flexibly connected and revoluble about a common axis, each biplane comprising pivoted planes and independently motor-actuated, each biplane having a supporting arm and provided with a wheel and arranged to adapt the plane to travel on the ground under the action of its motor.

16. In an aeroplane, a series of biplanes, each biplane having a supporting post to which its planes are fulcrumed, spacing cables arranged between the biplanes and connected to the posts, means to tilt the posts to simultaneously tilt all of the planes, operatively connected to the spacing cable, and means to tilt the planes of each biplane independent of its post.

17. In an aeroplane, an aviator's support, a member revoluble on the support, a series of biplanes flexibly connected to the member, each biplane having a post operatively connecting its planes together, and an actuating motor for each biplane, carried by the post and supported between the planes on the post.

18. In an aeroplane, an aviator's support, a member revoluble on the support, a series of planes flexibly connected to the member and revoluble about the support, a series of cams carried by the support, a tilting mechanism arranged between the member and each plane, having an operating bolt, and means to advance and retract the cams independently into and out of the path of the said bolts.

19. In an aeroplane, an aviator's support, a member revoluble on the support, a series of planes flexibly and operatively connected to the member, actuating motors carried by the planes, having propellers arranged to drive them about the support as a center, and means to successively tilt the planes at a greater angle to cause the machine to ascend higher at one side than at the other, operative from various points about the support.

20. In an aeroplane, an aviator's support, a member revoluble on the support, a series of biplanes connected to the support and revoluble thereabout, each biplane having a support on which its planes are carried, spacing cables extending between the upper and lower ends of the supports of adjacent biplanes, a ring drawing the upper and lower spacing cables together between each pair of biplanes, through which the cables are slidable, a drum carried on one of the

said supports adjacent to one of the cables, a line passing about the drum, having its ends connected to the other spacing cable adjacent to the rings, and means to revolve the drum, operative from the said support.

21. In an aeroplane, an aviator's support, a member revoluble on the support, a series of biplanes connected to the support and revoluble thereabout, each biplane having a support on which its planes are carried, spacing cables extending between the upper and lower portions of the supports of adjacent biplanes, a ring drawing the upper and lower spacing cables together between each pair of biplanes, through which the cables are slidable, a drum carried on one of the said supports adjacent to one of the cables, a line passing about the drum, having its ends connected to the other spacing cable adjacent to the rings, a second drum carried by the support and operatively connected to the first, a third drum supported on the revoluble member, means to rotate the last-named drum from the aviator's support, and a cable operatively connecting the second and third drums.

22. In an aeroplane, an aviator's support, a member revoluble on the support, a series of biplanes connected to the member, each biplane having a support to which its planes are pivoted to tilt forwardly and rearwardly, a drum carried by the support, a cable passing about the drum and extending to the outer portions of the planes of the biplane, and means to actuate the drum, controllable from the aviator's support.

23. In an aeroplane, an aviator's support, a member revoluble on the support, a series of biplanes connected to the member, each biplane having a support to which its planes are pivoted to tilt forwardly and rearwardly, a drum carried by the support, a cable passing about the drum and extending to the outer portions of the planes of the biplane, an actuating motor for each biplane, a friction driving mechanism arranged to operate the drum and driven from the motor, means to normally throw the said mechanism out of gear, and means to return the said mechanism into gear against the action of the last-mentioned means, controllable from the aviator's support.

24. In an aeroplane, an aviator's support, a member revoluble on the support, a series of biplanes connected to the member, each biplane having a support to which its planes are pivoted to tilt forwardly and rearwardly, a drum carried by the support, a cable passing about the drum and extending to the outer portions of the planes of the biplane, an actuating motor for each biplane, a friction driving mechanism arranged to operate the drum and driven from the motor, means to normally throw the said mechanism out of gear, an arm arranged to return the friction mechanism into gear against the action of the last-mentioned means, a cross-arm connected to the arm, a cross-arm fulcrumed to the member, cables connecting the ends of the arms together, a spring bolt carried by the cross-arm, fulcrumed to the said member, and a series of cams arranged about and carried by the aviator's support and independently movable into and out of the path of the spring-pressed bolts.

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

NAT ELMER BROWN.

Witnesses:
A. GLEMM,
C. C. COBURN.