

S. LAKE.
 FLYING MACHINE.
 APPLICATION FILED OCT. 13, 1915.

1,247,412.

Patented Nov. 20, 1917.
 8 SHEETS—SHEET 1.

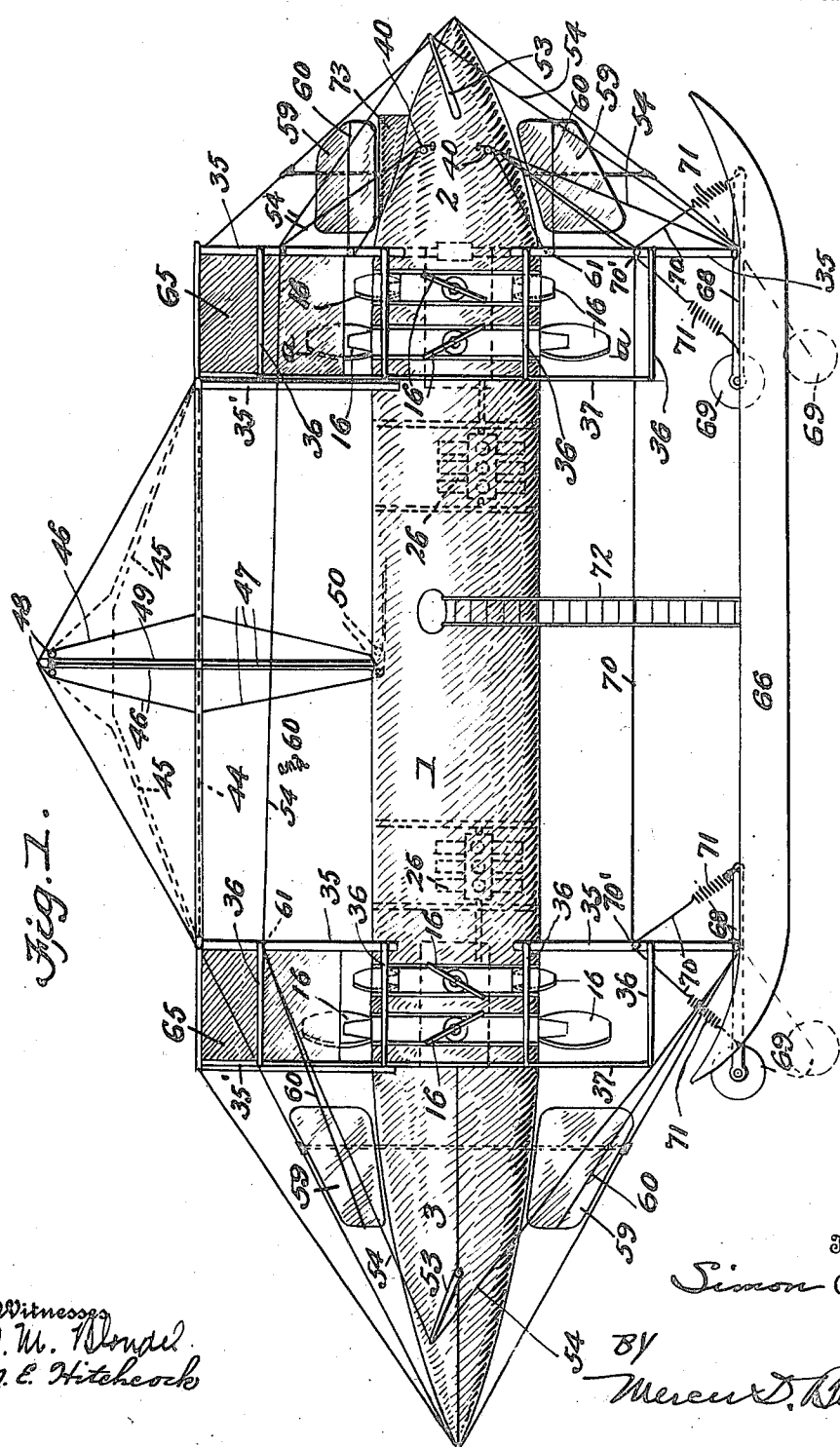


Fig. 1.

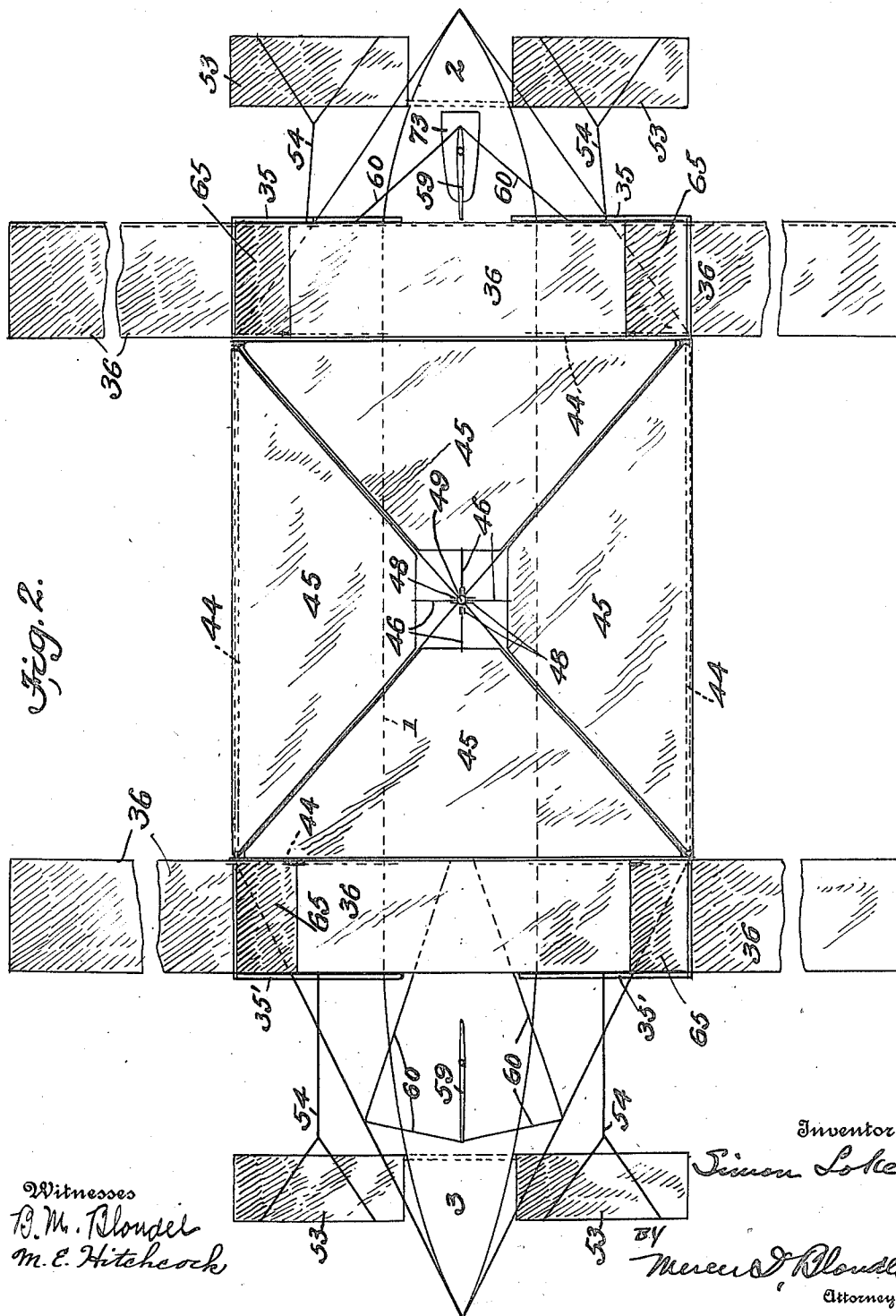
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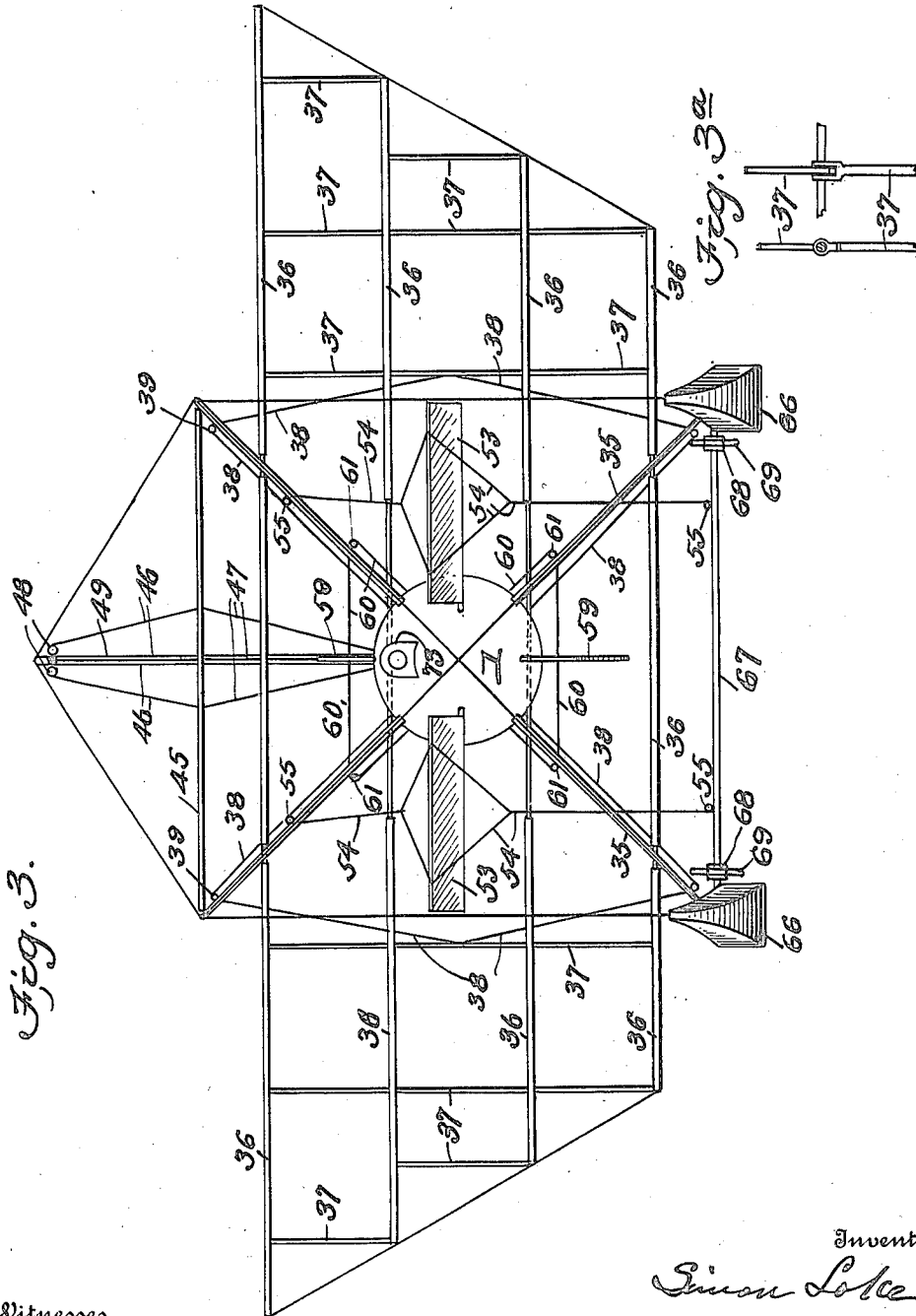


Fig. 3.

Fig. 3a.

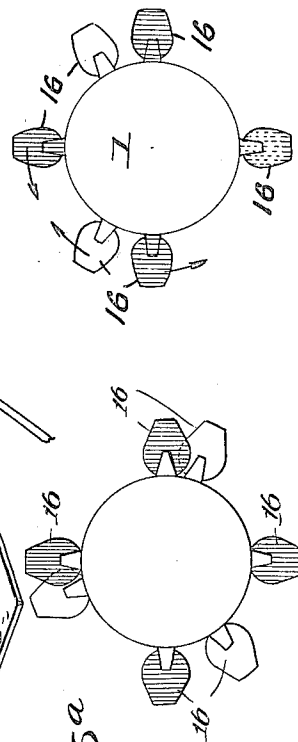
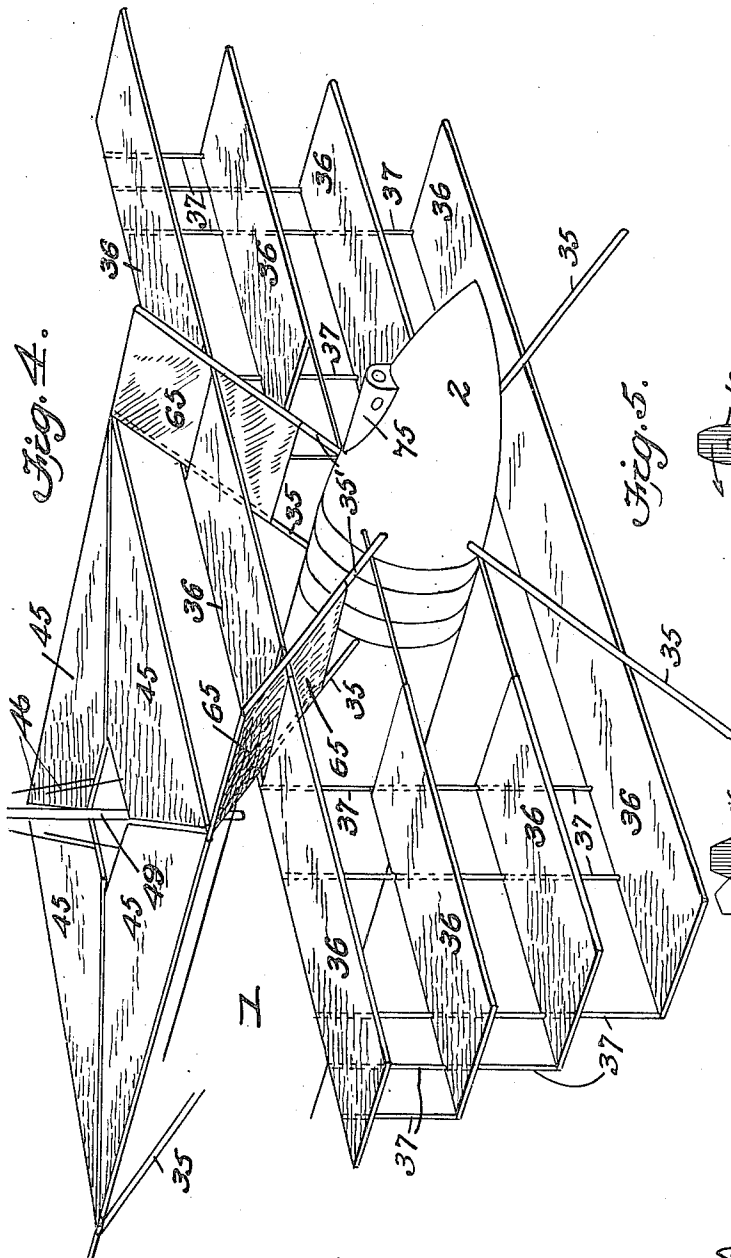
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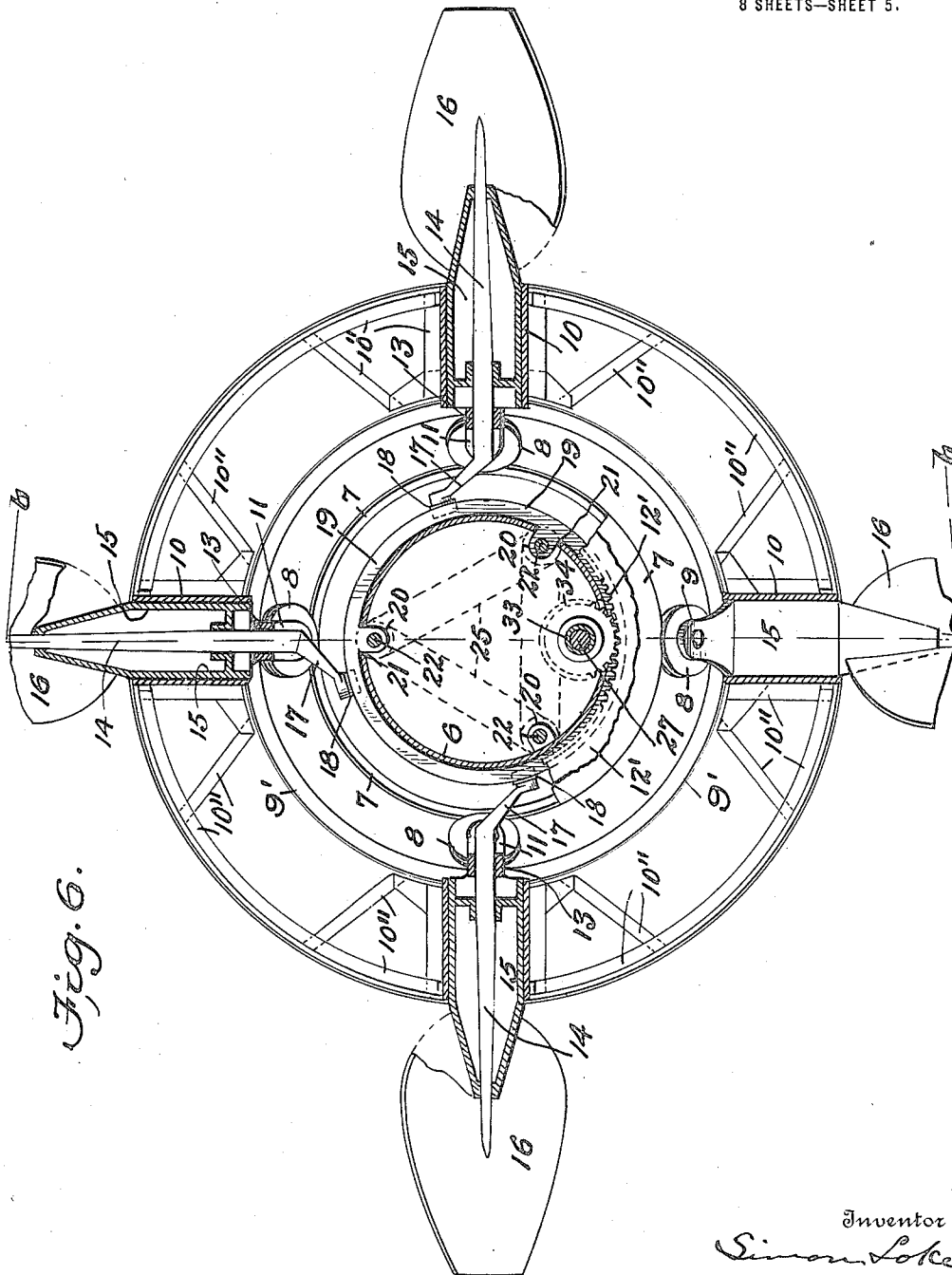


Fig. 6.

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8 SHEETS—SHEET 6.

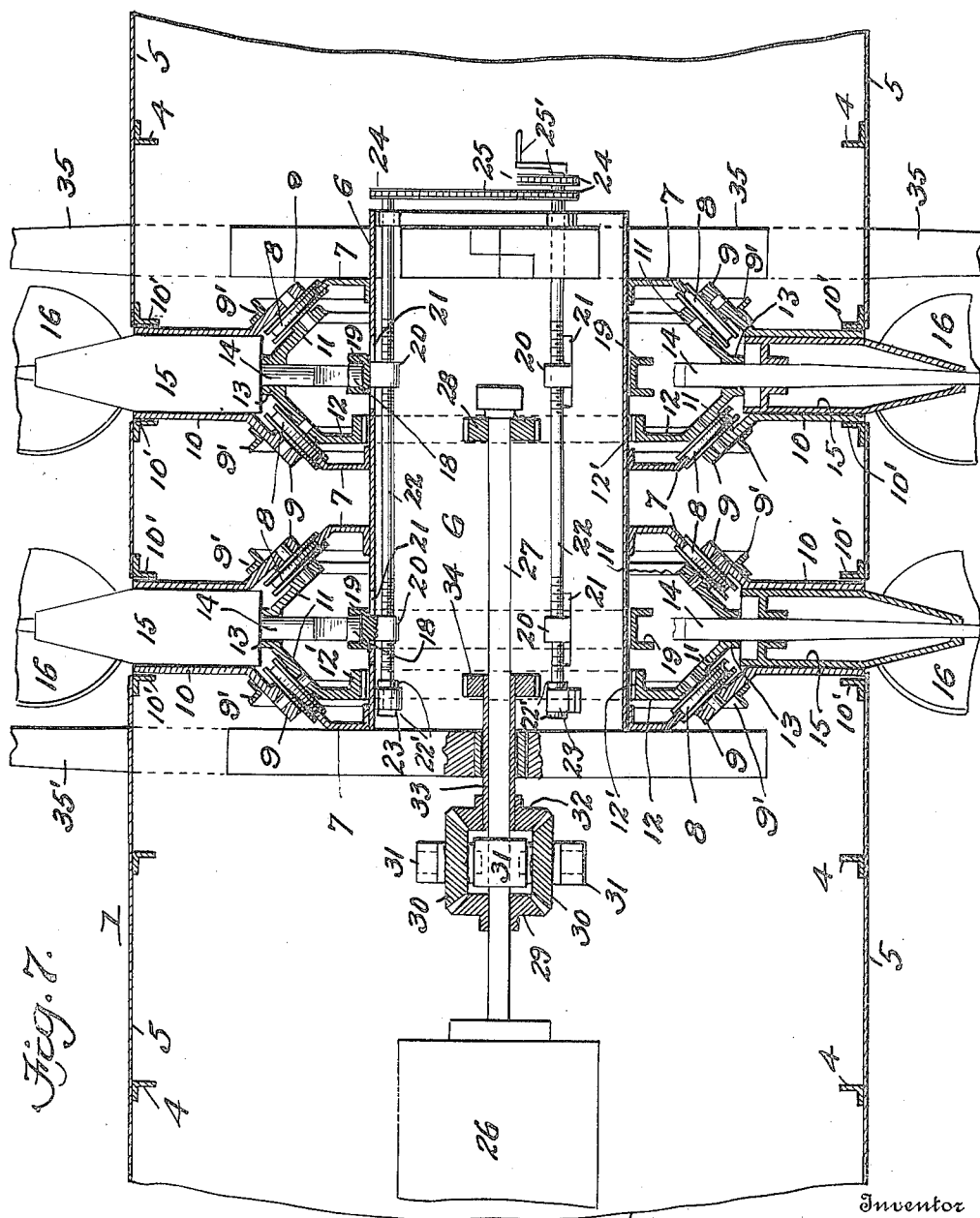


Fig. 7.

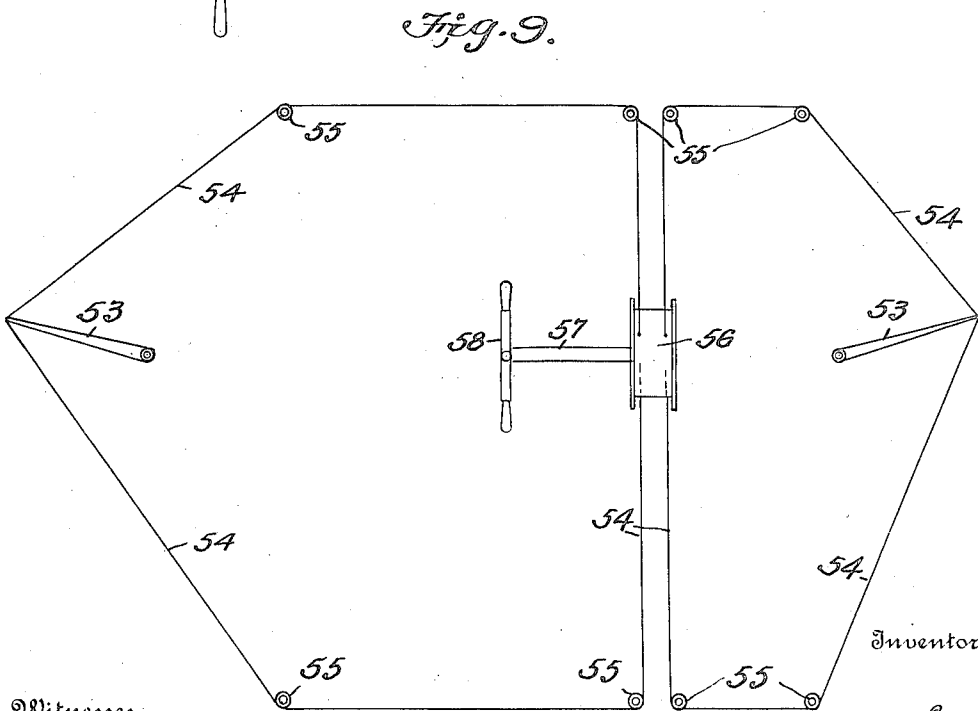
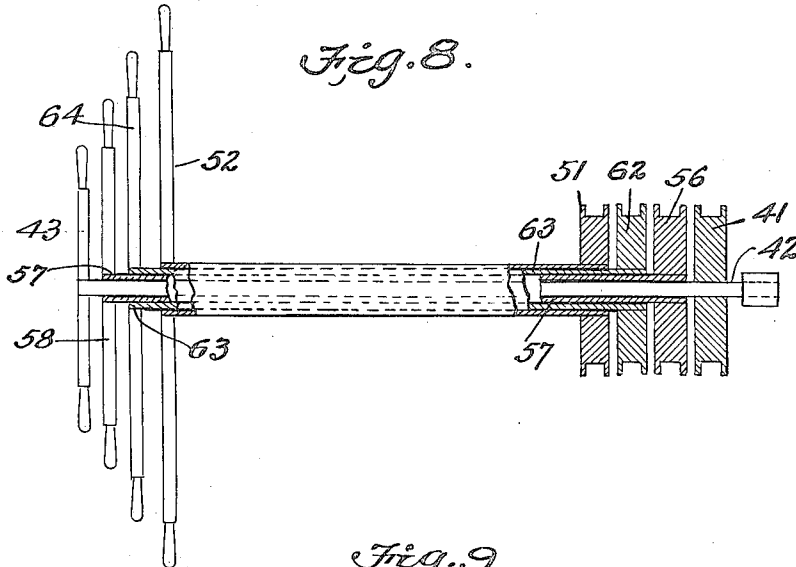
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8 SHEETS—SHEET 7.



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Fig. 10.

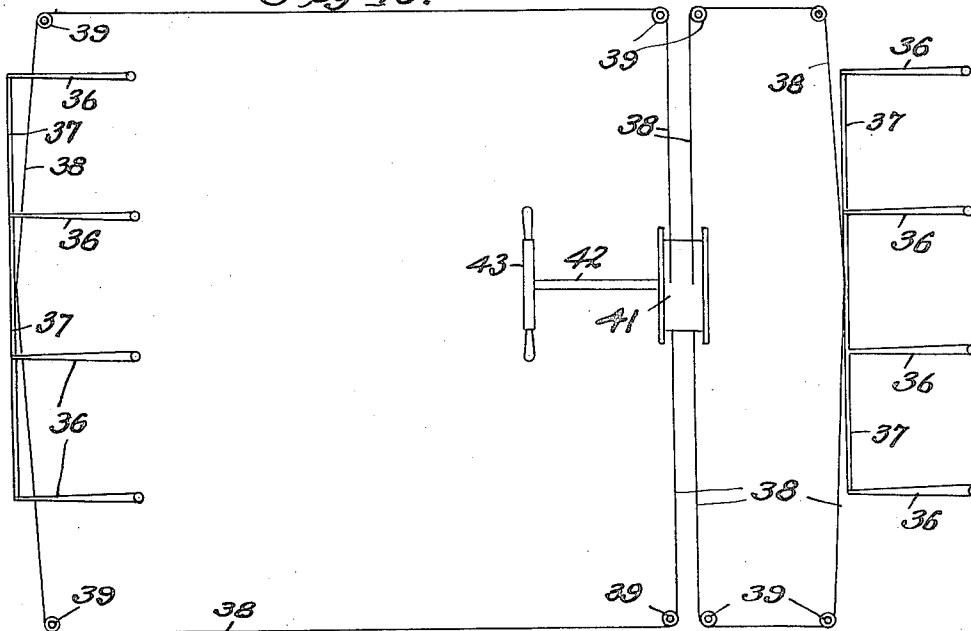
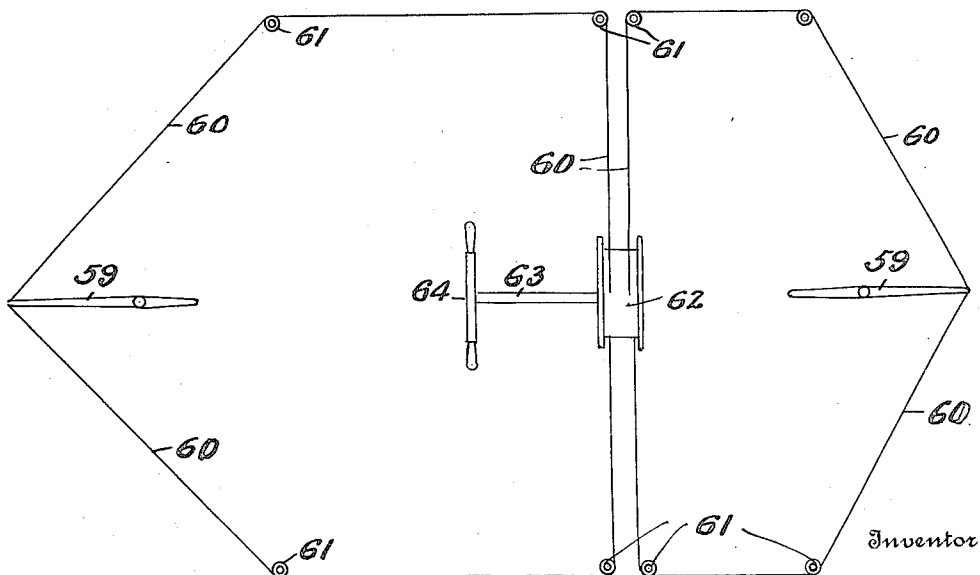


Fig. 11.



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UNITED STATES PATENT OFFICE.

SIMON LAKE, OF MILFORD, CONNECTICUT.

FLYING-MACHINE.

1,247,412.

Specification of Letters Patent.

Patented Nov. 20, 1917.

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To all whom it may concern:

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Milford, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Flying-Machines, of which the following is a specification.

This invention relates to an improvement in heavier-than-air-flying machines, and particularly to improvements in the constructions shown in Letters Patents granted to me June 2, 1908, and July 20, 1909, Nos. 889,693 and 928,524, respectively.

In the construction shown in my aforesaid patents, I employ hollow chambers designed to be filled with a gas lighter than the atmosphere to thus render them buoyant, the object of the constructions being to provide the ship with sufficient buoyancy to permit of a gradual descent in the event of the propelling mechanism being thrown out of order. My present construction obviates the necessity of the employment of these normally buoyant chambers, and the object of the invention is to provide a thoroughly rigid construction having the propellers thereof so located to provide a direct thrust and thus produce better stabilizing effects than has been possible in heavier-than-air machines heretofore employed, the propellers being so arranged that one counterbalances the other; and to provide a peculiar and novel arrangement of lifting planes, which are adjustable to cause them to act somewhat in the nature of a parachute, whereby to insure a gradual and safe descent in the event of the propelling machinery getting out of order; the construction, as a whole, being such that a high center of falling resistance and a low center of gravity is provided whereby to permit the machine to descend on an even keel in the event of the propelling mechanism being thrown out of order.

The invention further consists in certain novel features of construction, and in the peculiar combinations and arrangements of parts as will be hereinafter fully described and then claimed.

In the drawings, illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a diagrammatic side elevation of my improved flying machine. Fig. 2 is a plan view of the same, the intermediate portions of the ends of the main lifting planes being broken away

and the extreme ends moved inwardly. Fig. 3 is a diagrammatic front elevation of the machine, the cables and cushioning springs connected to the arms of the wheels being omitted. Fig. 3^a is a detail of construction. Fig. 4 is a fragmentary skeleton view in perspective of the forward end of the machine, illustrating the stabilizing planes. Fig. 5 is a diagrammatic view illustrating the arrangement of each pair of propellers. Fig. 5^a is a diagrammatic view illustrating the propellers at a different position during the revolution of the shaft from that shown in Fig. 5, to thus clearly illustrate the association of the blades of each set of propellers during the revolution of the same. Fig. 6 is an irregular transverse section drawn on a larger scale on the line *a— a* of Fig. 1, illustrating the mounting of the propellers. Fig. 7 is a detail vertical longitudinal section drawn on the line *b— b* of Fig. 6. Fig. 8 is a diagrammatic sectional elevation illustrating the arrangement of the tiller wheels for controlling the operation of the various planes and rudders of the machine. Fig. 9 is a diagrammatic view illustrating the operation of the horizontal steering rudders or planes. Fig. 10 is a similar view illustrating the operation of the main lifting planes. Fig. 11 is a similar view illustrating the operation of the vertical planes for steering the machine in horizontal direction.

1 designates, what I prefer to call, the body of the machine, preferably cylindrical in cross-section and having substantially conoidal forward and after ends 2 and 3, respectively, the body of the machine and the said ends being constructed of ribs 4, Fig. 7, and a covering of suitable material 5, which may be of canvas or light aluminum plating as desired. I have not attempted, nor do I think it necessary, to show the various struts and guy wires or lines for strengthening the construction of the body portion 1, since such details will be obvious to any one skilled in the art to which the invention relates.

Within the body portion 1, adjacent to the ends thereof, are short cylindrical sections 6, Figs. 6 and 7, each of which is provided with two pair of annular track members 7 over which operate grooved rollers 8 journaled in the outer ends of arms 9, carried by radially arranged cylinders 10, having their outer ends held between suitable guides 10' secured to the frame-work of the

body portion 1, and also journaled in arms 11, extending from annular rack sections 12 and 12', Fig. 7, the said arms 11 having short sleeve portions 13 through which extend shafts 14, secured to hubs 15, rotatably mounted in the said cylinders 10, the outer ends of the hubs 15 being provided with propeller blades 16, as shown. The cylinders 10 are connected by suitable frames 10'', Fig. 6, and the arms 9 by annular frames 9', so as to thoroughly brace the several cylinders of each set of propellers together. It is obvious that any suitable construction may be employed for bracing the cylinders to their respective rack frames other than that shown and described. The inner ends of the shafts 14 terminate in crank arms 17, Fig. 6, in the outer ends of which are journaled rollers 18, each operatively held in a grooved ring 19 mounted upon and adapted for longitudinal movement on the cylindrical section 6, the said ring having lugs 20 extending through slots 21 formed in the periphery of the cylindrical sections 6, and provided with threaded openings to receive threaded sections of shafts 22, journaled in lugs 23, secured to the inner side of the cylindrical sections 6, said shafts being protected against longitudinal movement by collars 22', shown in Fig. 7. One end of each shaft is provided with sprocket wheels 24 over which run sprocket chains 25, as shown in Figs. 6 and 7, and one of the shafts is provided with a crank handle 25' by which the shafts are simultaneously rotated so as to turn the propeller blades and thus adjust the pitch of the same, and to change the direction of thrust of the propellers.

In practice, I purpose constructing the forward propellers at each end of the machine with three blades, and the adjacent or after propellers at each end of the machine with four blades, the purpose of this construction being to avoid the blanketing of more than one propeller blade at a time during the rotation of the propellers, it being understood, and as illustrated in Fig. 5, that during the rotation of the propellers, it is possible for only one blade of the forward propellers to blanket a blade of its adjacent propeller at one time. The propellers are designed to operate in opposite directions so that one propeller will counter-balance the other, and all twisting movement, incident to the face of the blade impinging against the air, is positively avoided. In other words, by this arrangement of the propellers, I secure a direct thrust and a construction in which one propeller counter-balances the other, the twisting movement in one direction being counter-balanced by the twisting movement in the opposite direction; and furthermore, by constructing the forward propeller with three blades and each adjacent or after propeller with four blades, I

obtain uniform power, since the after blades necessarily operate in disturbed air currents.

Within the body portion 1, and located aft of the forward propellers and forward of the after propellers, as shown in dotted lines in Fig. 1, are the engines 26 for driving the propellers, the said engines being of suitable construction, and mounted so that their driving shafts will be arranged in longitudinal alinement with the cylindrical sections 6. The power shafts 27 of the engines have their outer ends provided with pinions 28, each being designed to mesh with the annular racks 12, and each shaft is provided with a beveled pinion 29, which meshes with beveled pinions 30 journaled in bearings 31 mounted within the body portion 1, and which in turn mesh with beveled pinions 32 carried by hollow shafts 33 mounted upon the shafts 27. Each hollow shaft carries a pinion 34 which is designed to mesh with its cooperating rack section 12'. By this arrangement, it will be apparent that as the engine is rotated in one direction or the other, the propellers of each pair will be rotated in opposite directions.

Extended diagonally through the body portion 1, forward of each set or pair of propellers, are stanchions 35, Figs. 1 and 4, in which are journaled the forward ends of (preferably four main) lifting planes 36 of gradually increased lengths from the lower planes toward the upper planes. These planes are constructed in the usual manner and their outer ends are connected by uprights 37, which are hinged to the outer frame-work of the planes 36, as shown in Fig. 3a, so as to provide for the slight turning movement resulting from the tilting of the planes as hereinafter described. To the inner uprights 37 of each set of planes are connected operating cables 38, Figs. 3 and 10, which extend over suitable guide pulleys 39, having their free ends extended over guides 40, Fig. 1, through the skin of the body portion 1, into the forward end of said body portion, and have their free ends wound in opposite directions over a drum 41 carried at the forward end of a shaft 42 suitably mounted in the forward end of the body portion 1, the rear end of the shaft being provided with a tiller wheel 43. It will be apparent as the drum 41 is rotated in one direction or the other, the outer ends of the main lifting planes 36 will be moved upwardly or downwardly, as will be hereinafter further explained.

Extending obliquely from the upper side of the body portion 1 of the machine, and in longitudinal alinement with the upper portions of the stanchions 35, are stanchions 35', and connected to the stanchions 35' and the upper portions of the stanchions 35, are ribs or wires 44, shown diagrammatically in Figs. 1 and 2. Journaled upon each of these

wires is a lifting plane 45, each being of substantially triangular form in plan, and these planes have their inner ends connected by cables 46 and 47, the cables 46 being extended upwardly and over pulleys 48, mounted at the upper end of a mast 49, extending from the body portion 1 of the machine, and thence downwardly over guide pulleys 50, and thence to and around a drum 51 mounted in the forward end of the machine, and which is rotated by a tiller wheel 52, as shown in Fig. 8. The cables 47 extend downwardly from the planes 45 and around the guide pulleys 50, Fig. 1, and thence around the drum 51 in opposite directions, in which the cables 46 are wound. By this arrangement, it will be apparent that when the drum is rotated in one direction or the other, the planes 48 may be raised and lowered. By thus constructing the planes as stated, they will, when elevated, form and serve as a parachute, whereby to stabilize the machine when descending without the influence of the propellers.

53 designates horizontal rudders or planes journaled at the forward and after ends of the machine. These planes are controlled by cables 54 which are extended around suitable guide pulleys 55, shown diagrammatically in Fig. 9, having their free ends wound in opposite directions upon a drum 56, mounted in the forward end of the machine and having its shaft 57 provided with a tiller wheel 58.

59 designates forward and aft vertical rudders for steering the machine in horizontal direction. These rudders are connected by operating cables 60, which are extended over guide pulleys 61, shown diagrammatically in Fig. 11, and have their free ends wound in opposite directions around a drum 62, also mounted in the body portion 1 of the machine, and having its shaft 63 provided with a tiller wheel 64.

In practice, the drums around which the various controlling cables are wound, will be mounted substantially as shown in Fig. 8, so the tiller wheels thereof will be grouped together and thus within easy reach of the single operator. Since it will be apparent to any one skilled in the art to which the invention relates, that various arrangements may be made for guiding the wires from the several planes to the operating drums; and since I do not make specific claim to such details, I have not thought it necessary to illustrate the wires and guides other than in diagrammatic form.

Arranged between and suitably connected to the upper ends of the stanchions 35 and their adjacent stanchions 35', are stabilizing planes 65, which serve the purpose to steady the machine when descending or settling when not under the influence of the propellers, and which also serve to prevent ex-

cessive inclination when the machine is steered in horizontal directions. With these planes, it will be apparent that if the machine should be inclined to heel when making a sharp turn, the planes 65 upon one side of the machine will be lowered and adjusted toward a horizontal direction, and the planes upon the opposite side will be adjusted toward a vertical direction, to thus offer resistances to the heeling tendency of the machine. While I have shown and described the stabilizing planes 65 as arranged forward and aft of the planes 45, and in vertical alinement with the main planes 36, it will be apparent that they may be located at other points along the body portion 1 of the machine. It will be noted, that in the location of the planes 65, as shown, the upper planes 36 are provided with openings through which the planes 65 extend, sufficient room being provided to permit of the adjustment of the planes 36 when they are moved upwardly and downwardly to cause the machine to ascend or to descend, when in flight under the influence of the propellers.

To the lower ends of the stanchions 35 are connected floats 66 of suitable construction, having upwardly inclined ends, as shown, the floats being preferably connected by cross-beams 67 (Fig. 3), upon which are mounted lever arms 68 having wheels 69 journaled in their after ends. The lever arms are mounted intermediate their ends, and to the forward and rear ends of the arms are connected cables 70, which are extended over suitable guide pulleys 70', Fig. 1, and thence into the forward end of the body portion 1, and have their free ends wound upon a drum (not shown) whereby the arms may be raised and lowered to thus permit the machine to travel over the land. In practice, when the machine is operating upon the surface of the water, the wheels will be elevated as shown in Fig. 1, so as to avoid friction. However, when landing upon or traveling over land, the wheels will be lowered to the position shown in dotted lines in Fig. 1. I purpose interposing springs 71 in the operating cables, whereby to cushion the wheels, as will be well understood. 72 designates a ladder extended from the floats to the body portion 1 of the machine. 73 designates a sighting hood.

In operation, in ascending, the main lifting planes 36 are adjusted to the position shown in Fig. 9, so that the passing air currents will impinge against the lower surfaces of the planes, as in all flying machines, the angle of the planes, of course, depending upon the speed of the engine and the consequent thrust of the propellers, it being understood that the angle at which the machine will ascend depends upon the statical stability of the machine, this is to say, with

a low center of gravity and a relatively high center of the sustaining planes the machine will incline upwardly until the pendulum effect of the center of gravity below the center of forward resistance counter-balances the lifting effect of the sustaining planes. Also in ascending, the horizontal rudders or planes 53 will be adjusted to the position shown in Fig. 9, so that during the flight of the machine, the passing air currents will strike upon the lower side of the forward plane 53 and upon the upper side or surface of the after plane 53, thus serving to elevate the forward end and depress the after end of the machine, so that but slight adjustment of the main sustaining planes 36 is necessary, it being understood that the planes 53 will thus serve to throw the machine out of horizontal position or at an angle to an "even keel position," hence causing the main lifting planes 36 to be presented at a slightly greater angle to the passing air currents with but little or no adjustment thereof. The main planes 36, and the horizontal rudders 53, are maintained in the positions above described until the machine has obtained the desired height, and it will be understood that these planes and rudders may be manipulated so as to change their angles of incidents, so as to thus cause the machine to rise or descend as occasions necessitate. It will be further understood, that during the flight of the machine, the vertical rudders 59 are operated so as to steer the machine in the desired direction. In "banking" or making a sharp turn, with my machine, as with all others, the machine is inclined to heel, and to avoid excessive and dangerous inclinations, I arrange the stabilizing planes 65 for counter-balancing this tendency and for maintaining the machine in horizontal position in transverse direction, it being understood that when making a sharp turn, the machine is inclined to "roll" as it were, and the surfaces of the stabilizing planes will strike against the air and thus check the rolling movement. Furthermore, these stabilizing planes being arranged at an angle with respect to the longitudinal axis of the machine, will also serve to stabilize the machine and maintain it on an even keel when "dropping" or descending when not under the influence of the propellers.

It may be stated here, that the center of the triangular planes is arranged in vertical alinement with the center of gravity of the machine.

In making a descent when the machine is "not under way", the planes 45 are adjusted to the positions shown in dotted lines in Fig. 1. These planes 45 then serve as a parachute, it being understood that during the descent, the air will strike against the lower surfaces of the planes and pass

upwardly and out through the central opening formed at the center or inner points of the planes, and thus not only check the downward momentum of the machine, but also to maintain the machine upon an even keel. Also, in the descent of the machine without the influence of the propellers, the planes 53 will be adjusted to the positions shown in Fig. 9, and these planes 53 combined with the planes 36 and the planes 45, will serve to check the downward momentum of the machine, as well as to maintain it in a horizontal position. While I have shown the inner points or "apices" of the planes cut away, it will be apparent that they may be extended to a point immediately adjacent to the mast 49.

As stated, I do not wish to confine myself to the exact location of the stabilizing planes 36, since they may be arranged in any location along the body of the machine best adapted to produce the results desired, it being apparent that they may be adjusted with better results forward and aft of the positions shown; nor do I wish to confine myself to the specific construction as shown for operating the several planes, as it will be evident to any one skilled in the art to which the invention relates, that various changes in the location of the several parts may be made without departing from the scope of the invention.

I furthermore desire it understood that as I am not claiming minor details of construction, I have not thought it necessary to show the arrangement of the wires or lines for operating the various planes of the machine other than in diagrammatic form.

While I have shown and described the main body portion 1 as substantially cylindrical in cross-section, it will be obvious that the same may be constructed octagon in shape, or of any other desired cross-sectional form. Furthermore, in a very long machine, three or more sets of propellers might be employed, and in a relatively short machine, only one set may be sufficient or even a single propeller. Also, in a small machine the propellers may be arranged at the extreme forward and after ends of the body portion 1.

It may be further stated that while I have shown and described the planes 45 as sectional planes with means for operating them, as specified, it will be apparent that a rigidly mounted plane with a central opening may be employed to equal advantage as the adjustable planes, it being understood, that when the machine is descending, when not under the influence of the propellers, the air will strike against the lower surface of the plane and escape out through the central opening, as with the use of a parachute, and while I consider the use of a series of adjustable planes as a

preferable arrangement, I do not want to be understood as limiting myself to this specific construction as it will be apparent that one rigid plane with a central opening may be used to equal advantage, the broad idea being to construct a machine with a plane or planes arranged above the center of gravity of the machine as a whole, whereby to not only check the downward momentum of the machine, but to balance the machine and maintain it on a substantially even keel both in longitudinal and transverse directions when descending without the influence of the propellers.

15 What I claim is:—

1. In a flying machine, a hollow body portion, propellers mounted therein and operable around the periphery of said body portion, main lifting planes located adjacent to the forward and after ends of the body portion, and obliquely arranged stabilizing planes mounted above and extending in diverging directions from said body portion.

25 2. In a flying machine, a substantially cylindrical body portion, propellers mounted therein and operable around the periphery of said body portion, main lifting planes located on the sides of the body portion thereof, and obliquely arranged stabilizing planes mounted above and extending in diverging directions from said body portion.

3. In a flying machine, a substantially cylindrical body portion, propellers mounted therein and operable around the periphery of said body portion, main lifting planes located adjacent to the forward and after ends of the body portion, and obliquely arranged stabilizing planes mounted above and extending in diverging directions from said body portion.

4. In a flying machine, a hollow body portion, propellers mounted therein and operable around the periphery of said body portion, lifting planes located on either side of the body portion, obliquely arranged stabilizing planes mounted above said body portion, a plane arranged above the center of gravity of the machine, said plane being adapted to serve as a parachute to thus check the downward momentum of the machine when descending when not under the influence of the propellers.

5. In a flying machine, a hollow body portion, propellers mounted therein and operable around the periphery of said body portion, lifting planes located adjacent to the forward and after ends of the body portion, obliquely arranged stabilizing planes mounted above said body portion, and a plurality of adjustable planes arranged above the center of gravity of the machine, said planes being adapted for adjustment to cause them to act as a parachute and thus

check the downward momentum of the machine when descending when not under the influence of the propellers.

6. In a flying machine, a hollow body portion, propellers mounted therein and operable around the periphery of said body portion, main lifting planes supported by said body portion, obliquely arranged stabilizing planes mounted above and extending in diverging directions from said body portion, and horizontal and vertical rudders also supported by said body portion.

7. In a flying machine, a body portion, propellers mounted therein, a series of adjustable lifting planes carried by said body portion, means for operating said planes, a plurality of adjustable planes grouped together above the center of gravity of the machine, as and for the purpose specified, and means for controlling the movement of said last mentioned planes, and obliquely arranged stabilizing planes located adjacent to the forward and after ends of said body portion and extending upwardly therefrom in diverging directions.

8. In a flying machine, a cylindrical body portion, propellers mounted therein, a series of adjustable lifting planes located adjacent to the forward and after ends of said body portion, means for operating said planes, a plurality of adjustable planes grouped together above the center of gravity of the machine, as and for the purpose specified, and means for controlling the movement of the last mentioned planes.

9. In a flying machine, a cylindrical body portion, propellers mounted therein and operable around the periphery of said body portion, said propellers being mounted in pairs, means for driving each pair of propellers in opposite directions, adjustable lifting planes mounted on either side of said body portion, a group of adjustable planes arranged above the center of gravity of the machine, obliquely arranged stabilizing planes mounted above said body portion, and independent means for controlling all of said planes.

10. In a flying machine, a cylindrical body portion, propellers mounted therein and operable around the periphery of said body portion, said propellers being mounted in pairs, means for driving each pair of propellers in opposite directions, adjustable lifting planes mounted adjacent to the forward and after ends of said body portion, a group of adjustable planes arranged above the center of gravity of the machine, obliquely arranged stabilizing planes mounted above said body portion, and independent means for controlling all of said planes.

11. In a flying machine, a cylindrical body portion, propellers mounted therein and operable around the periphery of said body portion, said propellers being mounted

in pairs, means for driving each pair of propellers in opposite directions, adjustable lifting planes carried by said body portion, a group of adjustable planes arranged above the center of gravity of the machine, obliquely arranged stabilizing planes mounted above said body portion, and independent means for controlling all of said planes.

12. In a flying machine, a hollow body portion, propellers journaled therein adjacent to the forward and after ends thereof adapted to rotate around the periphery of said hollow body portion, means for driving each pair of propellers in opposite directions, main lifting planes supported by and adjacent to the forward and after ends of said body portion, adjustable supporting planes mounted above the center of gravity of the machine, obliquely arranged stabilizing planes carried by and located in vertical alinement with said main lifting planes, and independent means for operating said main lifting planes and said adjustable supporting planes.

13. In a flying machine, a hollow body portion, propellers mounted therein and operable around the periphery of said body portion, obliquely arranged stanchions carried by said body portion, main lifting planes journaled to said stanchions and adapted for vertical movement at their free ends, means for controlling the movement of said planes, vertical steering rudders mounted adjacent to the forward and after ends of said body portion, means for operating said planes, obliquely arranged stabilizing planes mounted above said body portion, vertical steering rudders mounted at the forward and after ends of said body portion, and planes of substantially triangular form in plan mounted above the center of gravity of the machine, said planes being adapted for adjustment to cause them to serve as a parachute when the machine is descending when not under the influence of the propellers.

14. In a flying machine, a cylindrical hollow body portion, propellers mounted therein and operable around the periphery of said hollow body portion, stanchions extending diagonally through said hollow body portion, main lifting planes adjustably connected to said stanchions, said planes being arranged one above the other and of gradually increasing lengths from the bottom planes to the top planes, adjustable planes mounted above the said body portion between said main lifting planes, said latter planes being adjustable for the purpose specified, horizontal rudders journaled adjacent to the forward and after ends of the hollow body portion, vertical rudders also mounted upon said body portion adjacent to its forward and after ends, and independent means for controlling all of said planes,

15. In a flying machine, a cylindrical hollow body portion, propellers mounted therein and operable around the periphery of the said hollow body portion, stanchions extending diagonally through said hollow body portion, main lifting planes adjustably connected to said stanchions, said planes being arranged one above the other and of gradually increasing lengths from the bottom planes to the top planes, adjustable planes mounted above the said body portion between said main lifting planes, said latter planes being adjustable for the purpose specified, horizontal rudders journaled adjacent to the forward and after ends of the hollow body portion, vertical rudders also mounted upon said body portion adjacent to its forward and after ends, independent means for controlling all of said planes, and floats connected to the lower ends of said stanchions.

16. In a flying machine, a cylindrical hollow body portion, propellers mounted therein and operable around the periphery of the said hollow body portion, stanchions extending diagonally through said hollow body portion, main lifting planes adjustably connected to said stanchions, said planes being arranged one above the other and of gradually increasing lengths from the bottom planes to the top planes, adjustable planes mounted above the said body portion between said main lifting planes, said latter planes being adjustable for the purpose specified, a second set of stanchions extending upwardly in diverging directions from the said body portion in longitudinal alinement with the first mentioned stanchions, stabilizing planes secured to said stanchions, horizontal rudders journaled adjacent to the forward and after ends of the hollow body portion, vertical rudders also mounted upon said body portion adjacent to its forward and after ends, and independent means for controlling all of said planes.

17. In a flying machine, a hollow body portion, cylindrical sections mounted therein having their axes arranged in longitudinal alinement with the longitudinal center of said body portion, said cylindrical sections providing propeller bearings, propellers rotatably mounted on said cylindrical sections adapted to rotate in opposite directions around the periphery of said hollow body portion, and means for operating said propellers.

18. In a flying machine, a hollow body portion, cylindrical sections mounted therein in longitudinal alinement with the longitudinal center of said body portion, track members carried by said cylindrical sections, propeller blades rotatably mounted on the said track members adapted to rotate around the periphery of said hollow body portion,

means for changing the pitch of said propellers, and means for operating said propellers in opposite directions.

19. In a flying machine, a hollow body portion, cylindrical sections mounted therein adjacent to the forward and after ends thereof and in longitudinal alinement with the longitudinal center of said body portion, a pair of propellers rotatably supported by each of said cylindrical sections, the blades of which operate around the periphery of said hollow body portion, means for changing the pitch of said propeller blades, and means for operating said propellers in opposite directions.

20. In a flying machine, a hollow body portion, a pair of propellers mounted therein, the blades of which are adapted to operate around the periphery of said body portion, means for changing the pitch of the blades of the propellers, means for rotating the propellers in opposite directions, horizontal and vertical rudders mounted upon and adjacent to each end of the said body portion, and independent means for operating said planes and said rudders.

21. In a flying machine, a hollow body portion, cylindrical sections mounted therein

adjacent to the forward and after ends of the hollow body portion and in longitudinal alinement with the center thereof, track members carried by said cylindrical sections, propeller blades rotatably mounted on said track members adapted to rotate around the periphery of said hollow body portion, means for changing the pitch of the propeller blades, stanchions extending diagonally through said hollow body portion, main lifting planes carried by said stanchions, supporting planes adjustably mounted above said body portion between said main lifting planes, means for operating said last mentioned planes for the purpose specified, horizontal rudders and vertical rudders mounted at the forward and after ends of the body portion, and independent means for operating all of said planes and said rudders.

In testimony whereof I have hereunto set my hand this 18th day of September, A. D. 1915.

SIMON LAKE.

Witnesses:

J. ARTHUR PEASE,
M. E. HITCHCOCK.