M. G. ADAMS.

FLYING MACHINE.

APPLICATION FILED DEC. 5, 1908.

966,151.

Patented Aug. 2, 1910.

4 SHEETS—SHEET 1.

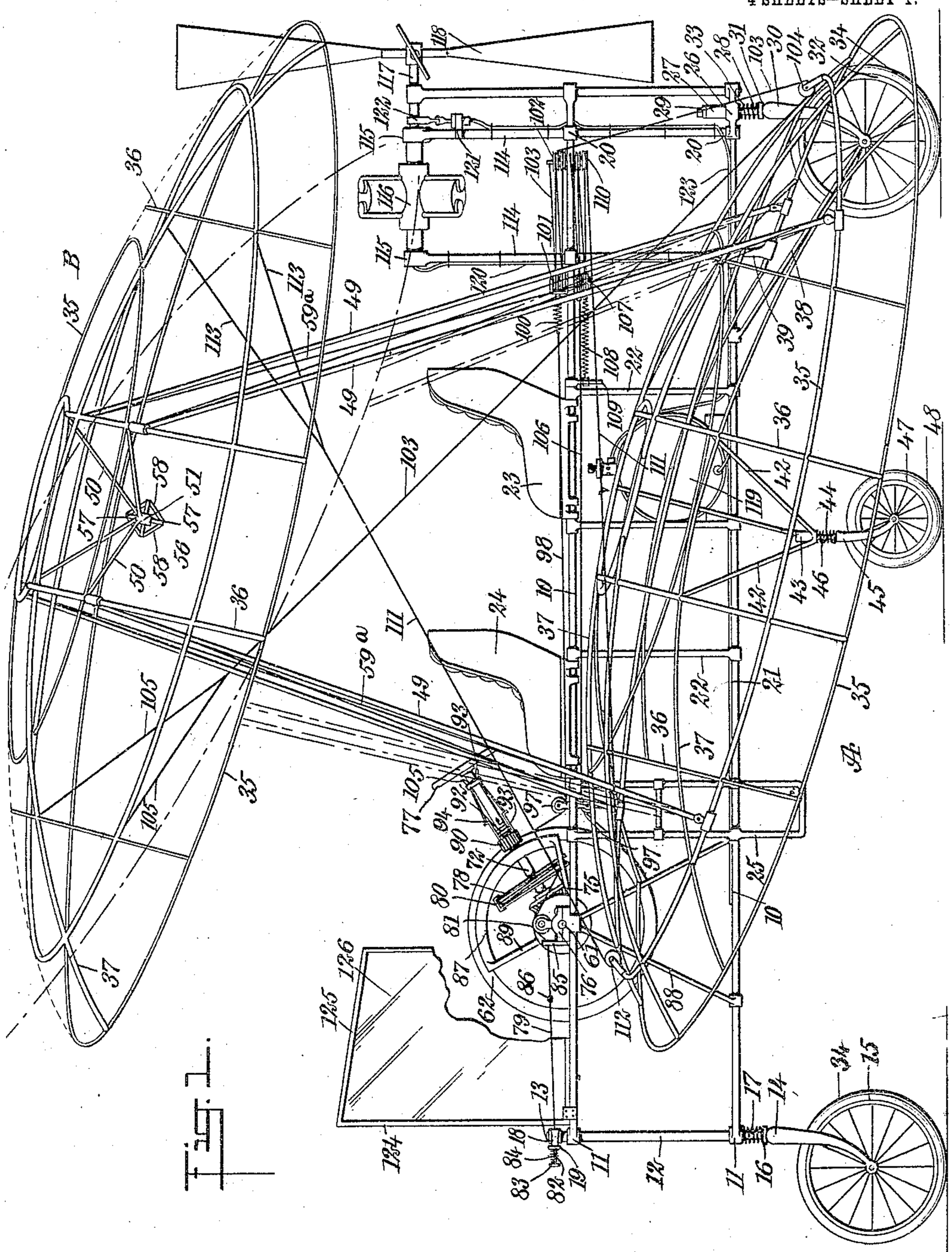

FIG. 1.

WITNESSES

John K. Bracken

INVENTOR

Malcolm G. Adams

BY Munn & Co.

ATTORNEYS

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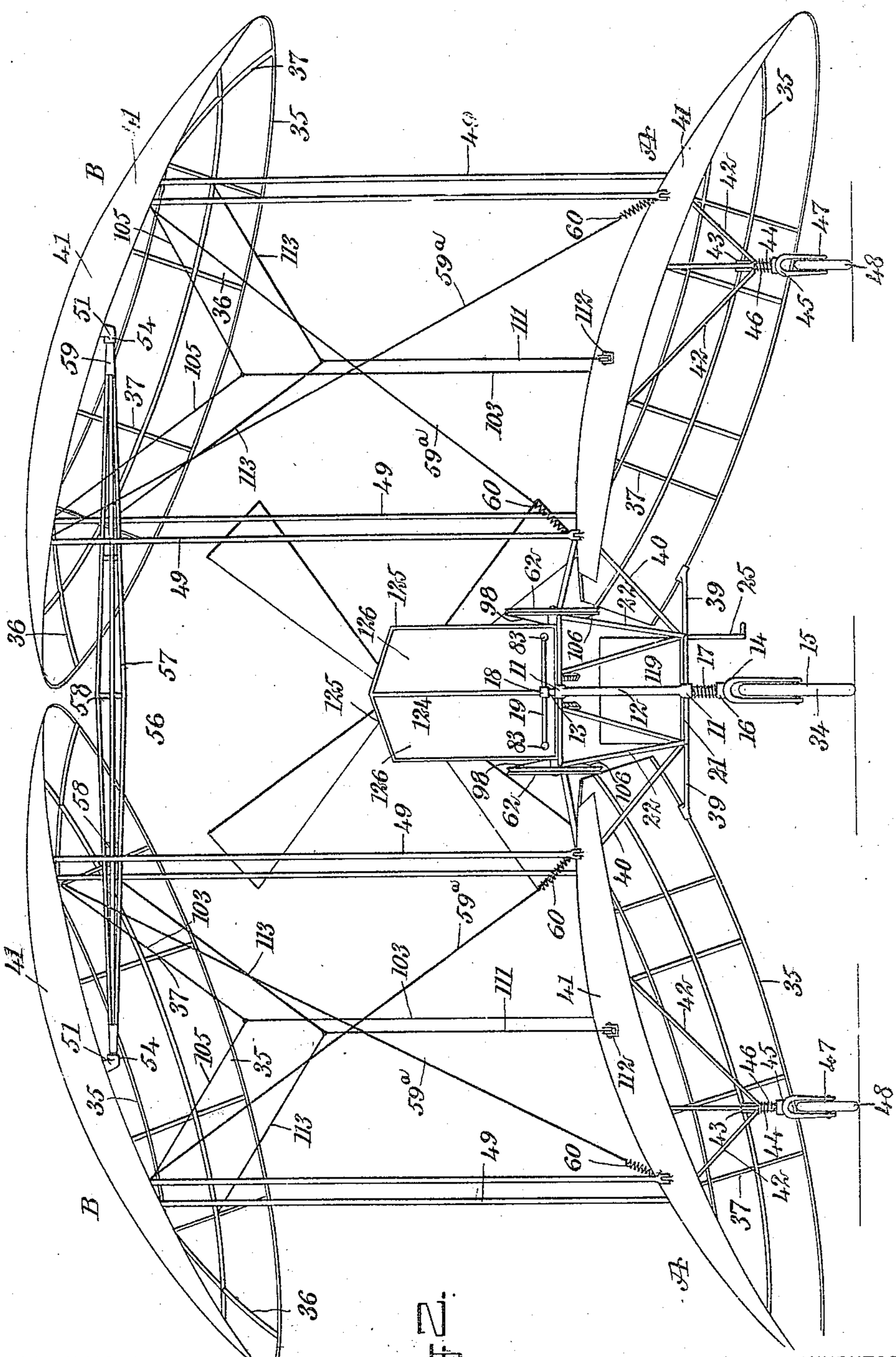

WITNESSES

John L. Bachrogel

INVENTOR

Malcolm G. Adams

BY Munn & Co

ATTORNEYS

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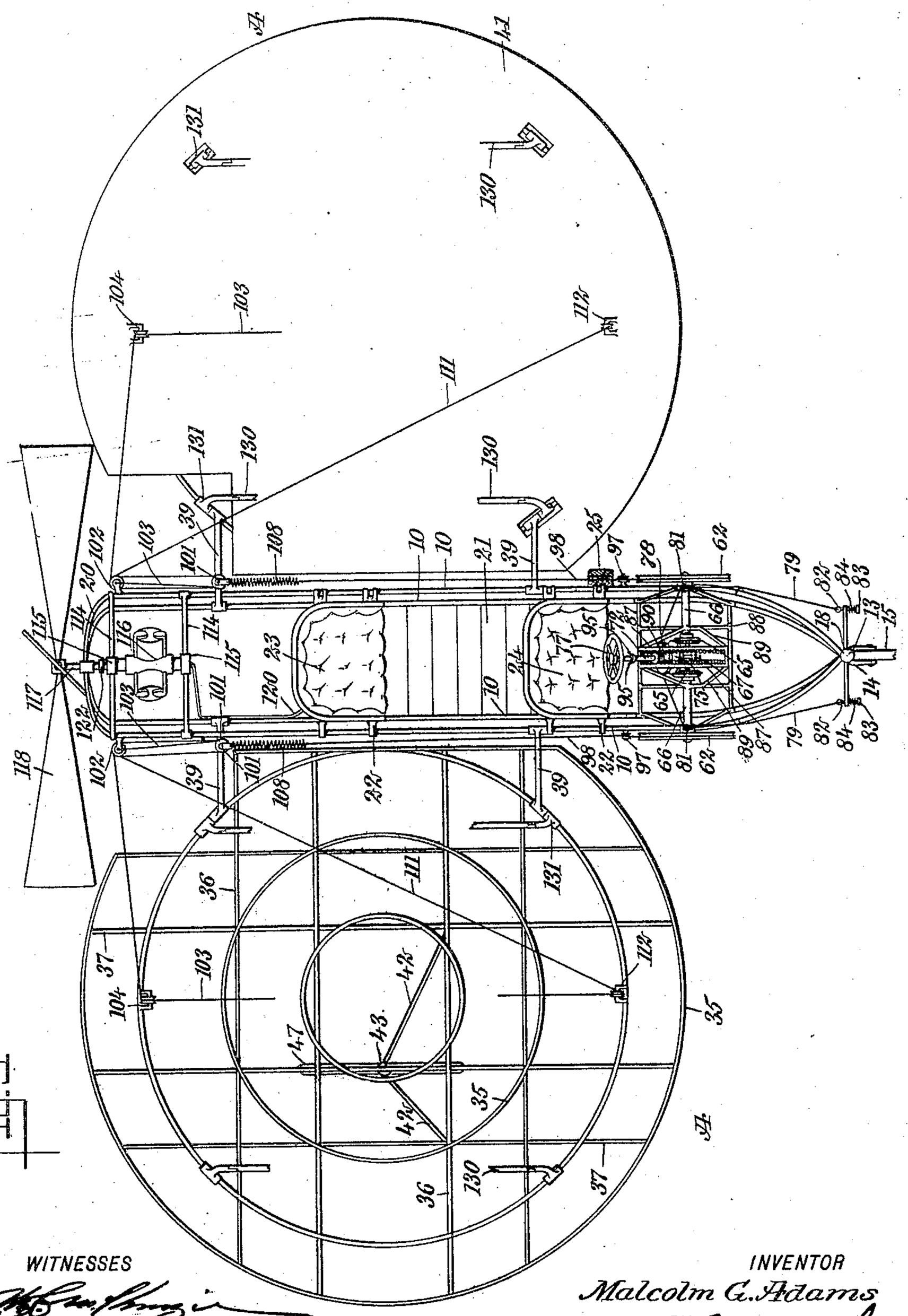

Fig. 2.

WITNESSES

John K. Bradbury 2d

INVENTOR

Malcolm G. Adams

BY Munn & Co

ATTORNEYS

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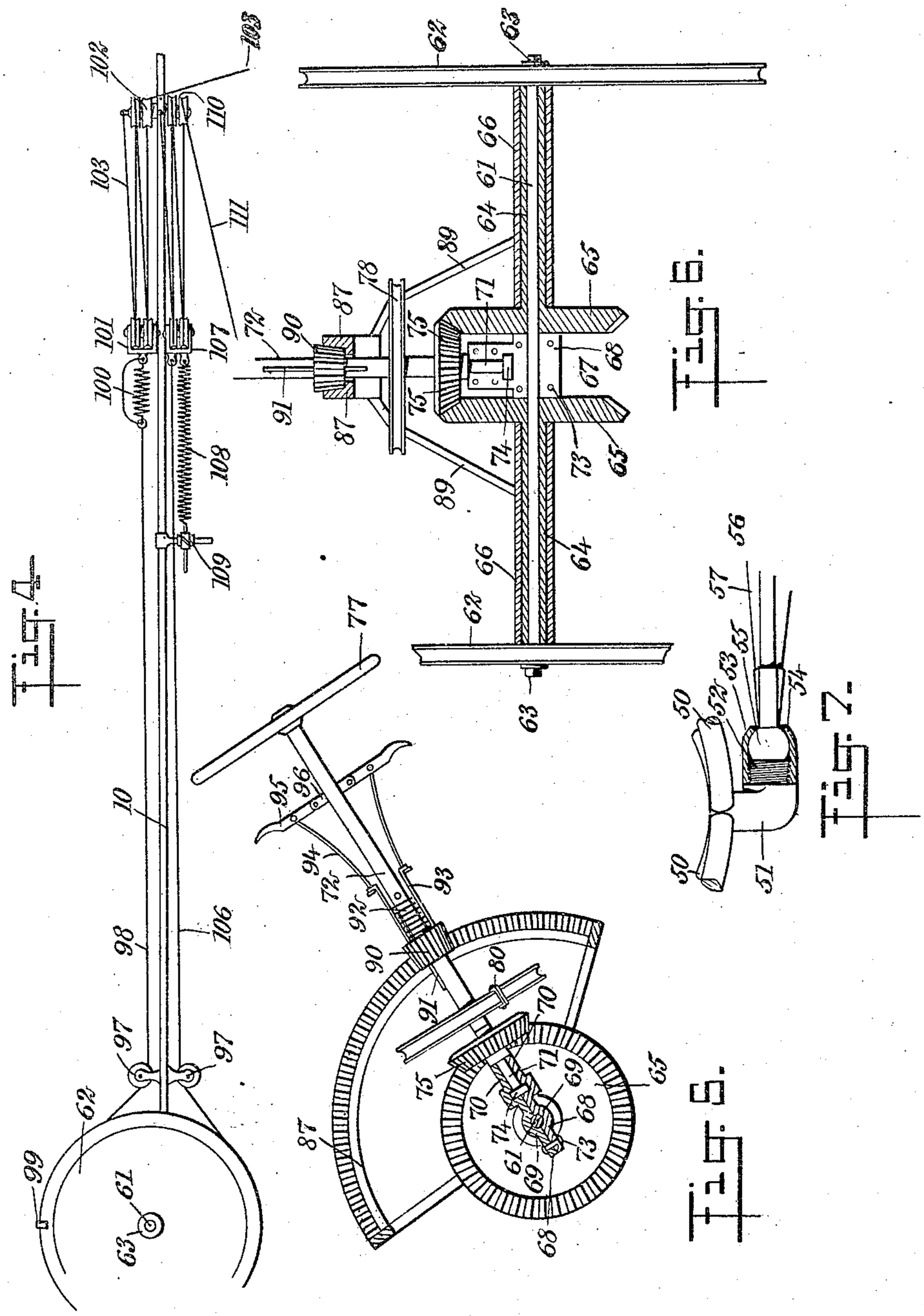

Fig. 4.

Fig. 6.

Fig. 7.

Fig. 5.

WITNESSES

John K. Bachmeyer

INVENTOR

Malcolm G. Adams

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

MALCOLM GROVER ADAMS, OF PARSONS, KANSAS.

FLYING-MACHINE.

966,151. Specification of Letters Patent. **Patented Aug. 2, 1910.**

Application filed December 5, 1908. Serial No. 466,096.

To all whom it may concern:

Be it known that I, MALCOLM GROVER ADAMS, a citizen of the United States, and a resident of Parsons, in the county of Labette and State of Kansas, have invented a new and Improved Flying-Machine, of which the following is a full, clear, and exact description.

This invention relates to flying machines, and more particularly to an aeroplane or heavier-than-air flying machine, in which the supporting surfaces consist of a plurality of superposed concave "domes" arranged in pairs and connected by links so that the upper domes are movable relatively to the lower domes, the adjustment of the upper domes consisting simultaneously in a fore and aft movement, and a tilting movement with respect to the lower domes, to vary the head resistance, the machine including suitable mechanism for controlling the domes, and propelling means for advancing the machine in the air.

An object of the invention is to provide a simple, durable and efficient heavier-than-air flying machine, which can be easily steered both on the ground and in the air, and in which the same mechanism can be used for steering it under both conditions.

A further object of the invention is to provide a flying machine which can be driven by any suitable form of motor, which can be maneuvered easily while in the air, which is at all times under the control of the operator, and which has a suitable running gear to permit the machine to travel upon the ground.

A still further object of the invention is to provide a machine of the class described comprising a plurality of superposed domes which are downwardly concave and have any suitable curvature, which are relatively movable with respect to one another so that they can be adjusted to alter the head resistance as well as to alter the lift, and in which the planes are arranged to minimize side slip or skidding when the machine is turning in one direction or the other.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

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 an embodiment of my flying machine showing certain parts in different positions in dotted outline; Fig. 2 is a front elevation of the machine; Fig. 3 is a plan view showing fabric or other surface material removed from one of the domes to disclose the frame-work thereof; Fig. 4 is an enlarged side elevation showing part of the dome controlling mechanism; Fig. 5 is an enlarged longitudinal section showing the steering mechanism; Fig. 6 is an enlarged transverse section showing the steering mechanism; and Fig. 7 is an enlarged front elevation showing a detail partly in section.

Before proceeding to a more detailed explanation of my invention, it should be clearly understood that the term "domes" is used to designate aeroplanes or supporting surfaces which are downwardly concave, that is, in the form of an inverted rounded bowl or similar body. The curvature of these domes may be of any suitable kind. They may for example, be spherical or parabolic, and preferably have the rims lying in flat planes. The domes are arranged in pairs, the domes of each pair being superposed, and the pairs being arranged side by side transversely of the longitudinal axis of the machine, that is, transversely of the direction of the flight of the machine. The corresponding domes of the pairs are arranged at angles with each other and they are downwardly inclined toward the rear and the sides of the machine. The domes are operatively connected and are controlled as will appear more clearly hereinafter.

It should also be understood that while in the form of the machine shown for example in the accompanying drawings, pairs of superposed planes are employed, I can also use a greater number of superposed planes or domes, if so desired. The lower domes are rigid and the upper domes are movable relatively thereto in the same manner as are the superposed planes shown and described in my Patent No. 917,513, dated April 6, 1909. In the type of flying ma-

chine there disclosed the upper planes are movable relatively to the lower ones so that they can be simultaneously tilted and moved bodily, being connected with the lower planes by links which are braced against movement transversely of the machine. By adjusting the upper plane, the head resistance as well as the angle of lift of the machine can be altered to cause the machine to turn in one direction or the other, and at the same time to cause the machine to travel upward or downward. The *modus operandi* is similar in the present case.

The provision of the downwardly concave planes or domes results in a machine which is steadier in flight and less sensitive to the effect of irregular currents of air than a machine in which the surfaces are plane. It has been demonstrated that arched surfaces are more efficient for aeroplane flying machines than flat or plane surfaces, and by the provision of doubly arched domes the stability of the flying machine, I have found, is increased.

Referring more particularly to the drawings, I provide a body or vehicle frame consisting of pairs of spaced, longitudinal members 10 fashioned from hollow tubing, wooden rods or any other suitable material and having the forward ends inclined toward each other and terminating in common sleeves or collars 11. A hollow post 12 is rigidly mounted in the collars 11 and has movably arranged therein a steering rod 13 terminating at the lower projecting end in a fork 14, between the sides of which is journaled a steering and supporting wheel 15. The fork has a crown 16 against which abuts a helical spring 17 arranged upon the rod 13 and engaging at the lower collar 11. At the upper projecting end of the rod 13 is a head 18 carrying a cross bar 19 by means of which the steering rod 13 can be controlled as will appear hereinafter.

At the rear of the body the members 10 are connected by cross members 20. The lower members 10 carry a floor 21 and are connected with the upper corresponding members 10 by posts or uprights 22 which form the body braces. Near the rear of the body is arranged a seat 23 for a passenger. The seat is securely mounted upon the upper frame members 10 and may be of any suitable form, and is preferably upholstered with a view to the comfort of the occupant. In front of the seat 23 is a second seat 24 which has a pivotal connection with one of the members 10, so that it can be swung aside to permit a person to pass beyond the same to the rear seat 23. At one side, the body has a ladder 25 which permits persons to enter the body.

At the rear end of the body, the members 20 carry a socket 26 in which is movably positioned a stem 28 which has a sleeve 27 engaging at the upper side of the socket, and against which abuts a head 29 at the upper end of the stem. The latter terminates in a fork 30 having a crown 31. A supporting wheel 32 is journaled between the sides of the fork. Braces 38 connect the lower ends of the fork sides and the lower frame members 10 of the body. A helical spring 33 is arranged upon the stem and engages the crown and the socket. The wheels 15 and 32 may be of any suitable form and are preferably similar to bicycle wheels, being provided with tires 34.

At each side of the body is arranged a lower dome A, consisting in the form of the machine illustrated for example herewith, of a plurality of circular frames 35 which are of different radii, and the radii of which are arranged on a central line or axis, so that the domes have circular rims and are downwardly concave. The circular frames 35 are connected by transverse frames 36 and 37. These frames may consist of hollow tubing or any other suitable material adapted for the purpose. The frames 36 and 37 intersect at suitable points and all the frames are brazed or otherwise firmly joined to insure that the structure of the dome is of suitable strength though light in weight. Each of the domes A is rigidly secured to the body of the machine by connecting members 39 and 40. The domes A are cut away at the edges adjacent to the body to provide room for the latter between the domes, as is shown most clearly in Figs. 2 and 3. Each dome has a suitable surface or covering 41 consisting of fabric, thin sheets of metal or any other material adapted for the purpose, and at the top has cross braces 130 secured to certain of the frames by bracket sleeves 131.

Within each dome A, are downwardly extending members 42 inclined toward each other and terminating in a socket 43. A stem 44 is movably located in the socket and carries a fork 45. A helical spring 46 upon each stem engages the corresponding fork and the corresponding socket to hold the stem in a normal position. A wheel 47 having a tire 48, and of any suitable form, is journaled between the sides of each fork 45 and serves to support the machine at the sides when it is traveling or resting upon the ground. The springs 17, 33 and 46 form cushions for absorbing shocks when the machine is traveling temporarily upon the ground, and resiliently mount the machine upon the supporting wheels.

Above each of the lower domes A, is arranged an upper dome B, similar in form to the lower dome and fashioned from like frames 35, 36 and 37, and as in the case of the lower dome, provided with a suitable surface or covering 41. The corresponding domes A and B are connected by links 49

each having its upper and lower ends pivotally connected with the corresponding upper and lower domes. The upper domes B, at the under side have downwardly extending and converging members 50 terminating in brackets 51 having laterally disposed threaded extensions 52 carrying correspondingly threaded sockets 53. The sockets have substantially central openings 54 and are formed to receive ball-shaped extremities 55 of a cross connection 56. The latter consists of a plurality of rods 57 joined by cross pieces 58 and is truss-shaped. The rods 57 converge toward the ends and are secured together in sockets 59 rigid with the extremities 55 of the member. By means of the connection 56 the upper domes B are operatively joined and are held against movement away from or toward each other, transversely of the machine, while free to move relatively to one another in other directions.

The links 49 permit the upper domes to swing in a fore and aft direction and at the same time cause the upper domes to be tilted up or down accordingly as they are swung forward or backward. Thus the upper domes can be simultaneously tilted and moved bodily, and their inclination can be altered as desired. By swinging the upper domes forward, the head resistance and the lift are increased, while in their swing backward the reverse is the case. By swinging one or the other of the upper domes forward, the head resistance at the corresponding side of the machine is altered and the machine is thereby caused to turn in one direction or the other. The opposite links 49 are connected by braces 59ª which prevent the links from moving laterally with respect to the machine, while permitting them to swing freely in a fore and aft direction. The braces include extensible sections consisting preferably of springs 60 to allow for slight movements and adjustments of the members incident to the operation of the machine.

The driver or operator of the flying machine assumes a position in the forward seat 24. In front of this seat is located the steering mechanism by means of which the machine is controlled. The steering mechanism includes a spindle 61. At the opposite side are rigidly mounted grooved pulleys or drums 62 held in place by nuts 63 or the like at the ends of the spindle. Hollow shafts 64 terminating at adjacent ends in bevel gears 65 are arranged loosely upon the spindle and have the gears spaced. Sleeves 66 are positioned upon the hollow shafts between the bevel gears and the drums. Between the gears 65 the shaft carries a bracket 67 consisting of similar plates 68 having oppositely offset or concave portions 69 which, together, form a bearing opening to receive the spindle. The plates have further offset parts 70 adapted to register to form a socket for the lower end 71 of a steering post or column 72. The plates 68 are rigidly secured together by bolts or rivets 73 or the like. The end 71 of the steering column has a laterally extended collar 74 which fits movably into a correspondingly formed part of the socket to hold the column rotatably in position. A bevel gear 75 is rigid with the steering column and is in mesh with the gears 65. The spindle, the hollow shaft and the sleeve are journaled upon the upper frame members 10 by means of suitable bearings 76. At the upper end, the steering column has a handwheel 77 by means of which it can be manipulated by the operator of the machine.

Above the gear 75 the shaft carries a rigid pulley or drum 78 which is grooved to receive lines 79. The latter are secured at the rim of the wheel by a clip 80 and pass under grooved guide wheels or pulleys 81 to the cross bar 19 of the front or steering wheel. The lines 79 are fastened to slides 82 arranged in openings at the ends of the cross bar, and having heads 83. The slides have springs 84 thereon which engage the heads 83 and the cross bar to effect a resilient connection between the lines 79 and the cross bar. One of the lines passes through an opening in an abutment 85 and carries a stop 86 adapted to engage the abutment to limit the movement of the line in one direction.

At each side of the steering column is positioned a toothed segment 87 mounted upon a framework 88 extending between the upper members 10 and supported by legs or uprights 89. A toothed member or gear 90 is slidably mounted upon the steering column and has a kerf engaging a rib 91 of the column so that the gear 90 is constrained to rotate with the column. It is adapted to engage the toothed segments and is normally held in such engagement by a spring 92. The gear 90 has arms 93 secured at the ends to pulls 94 which are pivotally connected with levers 95. The latter are in turn pivoted upon ears 96 of the steering column and serve to displace the gear 90 from engagement with the segments. The operator of the machine can release the gear by pulling the levers 95 upward and when these are in alinement with the pulls and the arms, or lie adjacent to the steering column, the gear will be held inoperative. By means of the segments and the gear, the steering mechanism can be locked in a plurality of positions.

Upon each of the upper body members 10 at the upper and lower sides thereof, respectively, are grooved guide pulleys 97. Under each of the upper of these passes a line 98 secured to the corresponding drum

62 by means of a clip 99 or the like. Each line 98 includes a spring 100 and is fastened to a double pulley 101 which is movable along the member 10. A further double pulley 102 is fixed upon the member 10 and has secured thereto the end of a line 103. This line 103 passes around the double pulleys and under a guide pulley 104 carried at the rear of one of the lower domes A. The line then passes to the front of the corresponding upper dome B and there has two branches 105 secured respectively near opposite sides of the upper dome. Each drum 62 has secured thereto a second line 106 which passes under the corresponding lower pulley 97 to a double pulley 107. A spring 108 is secured to the double pulley 107 and has the end remote from the pulley rigidly supported by an adjustable bracket 109 mounted upon the frame member 10 and permitting the tension of the spring 108 to be varied. A second double pulley 110 is rigidly carried upon the member 10 and a line 111 has an end secured to the member 10 and passes around the double pulleys 107 and 110 to a guide pulley 112 mounted near the front of one of the lower domes A. The line 111 then passes upward to the rear of the corresponding upper dome B and has there two branches 113 each secured respectively at one side near the rear of the upper dome A. These lines as will appear more clearly hereinafter, control the upper domes.

The body of the machine at the rear, has uprights 114 which terminate at the upper end in bearings 115. In these bearings is journaled a rotary motor 116 having a driving shaft 117 upon which is mounted the propeller 118. While this form of motor is shown for example in the drawings herewith, needless to say, any other suitable type of prime mover can be employed. Underneath the rear seat 23 is arranged a fuel tank 119 for supplying the motor with fuel, and it is connected with the motor by a pipe 120. An air pump 121 is secured upon one of the uprights and has an eccentric connection 122 with the shaft 113 so that the pump can be operated when the shaft is rotated. The pump is connected by a pipe 123 with the fuel tank and thus serves to place the fuel under pressure, as in the construction shown a gravity feed is not available.

A wind shield 124 is provided at the front of the machine, and consists of frames 125 each positioned upon one of the upper body members 10 at the front thereof, whereby the frames are inclined with respect to each other and form a substantially V-shaped shield. The frames have transparent sheets 126 of glass or other suitable material to protect the driver from wind and moisture. Of course, the shield can be dispensed with if necessary or desirable.

The steering mechanism serves at the same time for turning the front or steering wheel in one direction or the other and for adjusting the upper domes so that they can be employed for steering the machine when the same is traveling on the ground and when it is traveling in the air. By turning the steering column in one direction, the drum 78 is actuated to turn the steering wheel in a corresponding direction through the agency of the lines 86. At the same time the gear 75 turns the gears 65 in opposite directions to rotate the drums 62 in corresponding opposite directions. The movement of the drums 62 is transmitted to the lines 98 and 106 respectively and these in turn actuate the double pulleys 101 and 107. Owing to the provision of the double pulleys a movement of the line 98 or of the line 106 is multiplied when transmitted to the lines 103 and 111 respectively. A movement of the double pulley 101 toward the steering mechanism pulls upon the line 103 to swing the corresponding upper domes backward, at the same time tilting them downward. This movement is effected against the resistance of the spring 108. An opposite movement of the drum would permit the spring 108 to swing the corresponding upper dome forward, and to tilt it upward. The simultaneous tilting and bodily movement of the upper dome is due to the provision of the links, as can be easily seen.

By turning the steering column in one direction or the other the drums 62 are oppositely turned, through the gears, so that as one of the upper domes is turned forward and tilted up, the other upper dome is moved backward and tilted down. By thus changing the inclinations of the upper domes, the head lifts at the sides of the machine are altered, causing the machine to swing in one direction or the other, whereby it can be maneuvered in the air. The springs 100 take up any slack in the lines and tend to maintain the same taut. The springs 108 serve to hold the upper domes in normal position and tend to swing the upper domes forward and to tilt them upward. The cross connection 56, the ends of which form ball and socket joints with the brackets 51, permit the upper domes to move in fore and aft directions, and to tilt with respect to each other.

If it is desired to cause the machine to rise or descend, it is necessary to vary the inclination of the upper domes equally. To accomplish this purpose the levers 95 are swung back to withdraw the gear member 90 from engagement with the segment 87 so that the steering column can be moved backward or forward pivotally about the spindle. Through the engagement of the gear 75 with the gears 65 a movement of the steering columns rotates both the drums in

the same direction and consequently both upper domes are similarly adjusted. A swinging movement of this kind, of the steering column does not affect the front or steering wheel for land travel, as the radius of swing of the drum 78 is substantially centered at the pulleys 81. Any slight differences tending to pull upon or loosen the lines 79 are taken up by the spring 84.

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

1. In a flying machine, pairs of superposed domes arranged side by side, corresponding domes of said pairs being at angles with each other, whereby said domes are inclined downward toward the sides of the machine.

2. In a flying machine, pairs of superposed domes arranged side by side, corresponding domes of said pairs being at angles with each other, whereby said domes are inclined downward toward the sides of the machine, and whereby said domes are inclined downward toward the rear of the machine, and a car positioned between said lower domes of said pairs.

3. In a flying machine, pairs of superposed planes arranged side by side, corresponding planes of said pairs being at angles with each other, whereby said planes are inclined downward toward the sides of the machine.

4. In a flying machine, pairs of superposed supporting surfaces arranged side by side, corresponding surfaces of said pairs being at angles with each other, whereby said surfaces are inclined downward toward the sides of the machine, and whereby said surfaces are inclined downward toward the rear of the machine.

5. In a flying machine, adjustable supporting surfaces, adjustable controlling lines, and connections between said surfaces and said lines, whereby the movements of said lines are multiplied when transmitted to said surfaces to adjust the same.

6. In a flying machine, a plurality of superposed domes, the upper of said domes being adjustable, a controlling line, steering mechanism for operating said line, a multiplying pulley controlled by said line, and a further line connecting said adjustable dome and said pulley.

7. In a flying machine, a plurality of superposed domes, one of said domes being adjustable to guide the machine, a line controlling said adjustable dome, and steering mechanism for operating said line.

8. In a flying machine, a plurality of superposed domes, one of said domes being adjustable to guide the machine, a resiliently extensible line controlling said adjustable dome, steering mechanism for operating said line, and resilient means tending to hold said adjustable dome in a normal position.

9. In a flying machine, an adjustable supporting surface, an adjustable steering wheel, and steering mechanism for simultaneously controlling said surface and said wheel, said mechanism being adjustable whereby said surface can be controlled independently of said wheel.

10. In a flying machine, an adjustable supporting surface, a steering wheel, a steering post, and means connecting said post, said surface and said wheel, whereby a rotary movement of said post adjusts both said surface and said wheel, and whereby a swinging movement of said post adjusts said surface alone.

11. In a flying machine, an adjustable supporting surface, a steering wheel, a steering post arranged to be operated pivotally and to be operated rotatably, and lines connecting said post with said surface and said wheel, whereby a rotary movement of said post adjusts both said surface and said wheel, and whereby a pivotal movement of said post adjusts said surface alone.

12. In a flying machine, a plurality of superposed supporting surfaces, certain of said surfaces being independently adjustable, a steering wheel, a steering post, lines connecting said steering post with said wheel and said adjustable surfaces, and springs tending to hold said adjustable surfaces in normal positions, said steering post being rotatable and being movable about an axis transverse of its length, whereby a rotary movement of said post simultaneously adjusts said adjustable planes in opposite directions and said wheel, and whereby a swinging movement of said post adjusts said planes alone and in the same direction.

13. In a flying machine, adjustable supporting surfaces, steering mechanism comprising relatively movable parts, a steering post having a plurality of movements and controlling said parts, whereby a rotary movement of said steering post operates said parts in opposite directions, and whereby a swinging movement of said post operates said parts in the same direction, and lines operatively connecting each of said parts and one of said surfaces, said lines having means for multiplying the movements of said parts.

14. In a flying machine, adjustable supporting surfaces, steering mechanism comprising relatively movable parts, a steering post having a plurality of movements and controlling said parts, whereby a rotary movement of said steering post operates said parts in opposite directions, and whereby a swinging movement of said post operates said parts in the same direction, lines operatively connecting each of said parts and one of said surfaces, means carried by

said post for locking the same against a free swinging movement, and means for releasing the same whereby said post can be freely swung.

15. In a flying machine, adjustable supporting surfaces, steering mechanism comprising relatively movable parts, a steering post having a plurality of movements and controlling said parts, whereby a rotary movement of said steering post operates said parts in opposite directions, and whereby a swinging movement of said post operates said parts in the same direction, lines operatively connecting each of said parts and one of said surfaces, a toothed member, a gear slidable upon said post and adapted to engage said toothed member to hold said post against a free swinging movement, and a lever controlling said gear, whereby the same can be disengaged from said toothed member and can be held inoperative.

16. In a flying machine, adjustable supporting surfaces, independently movable shafts, gears rigid therewith, a steering post arranged to swing, a gear rigid with said steering post and in mesh with each of said gears of said shafts, lines controlled by said shafts and each controlling one of said surfaces, a steering wheel, a line controlled by said steering post and serving to operate said steering wheel, a notched segment, and a member slidable on said steering post and adapted to engage said segment to hold said steering post against a free swinging movement, said member being displaceable into an inoperative position.

17. In a flying machine, relatively adjustable supporting surfaces, a spindle, shafts loose upon said spindles and each having a gear at one end, a bracket rotatably mounted upon said spindle and having a socket, a steering post rotatably mounted in said socket, whereby said steering post is free to swing about said spindle, a gear rigid with said steering post and in mesh with said gears of said shafts, a drum rigid with said post, a steering wheel, lines connecting said drum and said steering wheel, whereby a rotary movement of said post adjusts said steering wheel, drums, each rigid with one of said shafts, lines controlled by said drums, multiplying pulleys controlled by said lines, and further lines, each controlling one of said surfaces and each passing around certain of said multiplying pulleys, said first lines having resilient means for taking up slack, certain of said pulleys having resilient means tending to hold them in normal positions.

18. In a flying machine, relatively adjustable supporting surfaces, a spindle, shafts loose upon said spindle and each having a gear at one end, a bracket rotatably mounted upon said spindle and having a socket, a steering post rotatably mounted in said socket, whereby said steering post is free to swing about said spindle, a gear rigid with said steering post and in mesh with said gears of said shafts, a drum rigid with said post, a steering wheel, lines connecting said drum and said steering wheel, whereby a rotary movement of said post adjusts said steering wheel, drums, each rigid with one of said shafts, lines controlled by said drums, multiplying pulleys controlled by said lines, further lines, each controlling one of said surfaces, and each passing around certain of said multiplying pulleys, said first lines having resilient means for taking up slack, certain of said pulleys having resilient means tending to hold them in normal positions, a toothed segment, a gear slidable upon said post and adapted to engage said segment to hold said post against a swinging movement, a spring normally forcing said last-mentioned gear into engagement with said segment, and a lever whereby said gear can be displaced against the tension of said spring.

19. In a flying machine, relatively adjustable domes each having a bracket presenting a socket, and a connecting member having an end in each of said sockets, whereby said member has a universal joint connection with each of said domes.

20. Steering mechanism, comprising a shaft, relatively movable sleeves upon said shaft and each having a gear rigid therewith, guiding means for the machine, controlling means for said guiding means, said controlling means being operable by said sleeves, and a steering post mounted upon said shaft between said sleeves and arranged to rotate and to swing, and having a gear in mesh with each of said gears of said shaft.

21. In a flying machine, a plurality of superposed domes resiliently braced transversely, said domes being substantially of the form of spherical segments.

22. In a flying machine, an adjustable surface, adjustable lines controlling said surface, and connections between said surface and said lines whereby the movements of said lines are multiplied when transmitted to said surface to adjust the same.

23. In a flying machine, an adjustable surface, a controlling line, steering mechanism for operating said line, a multiplying pulley controlled by said line, and a further line connecting said adjustable surface and said pulley.

24. In a flying machine, an adjustable surface, lines controlling said surface, and connections between said surface and said lines whereby the movements of said lines are multiplied when transmitted to said surface, said lines being resiliently extensible.

25. In a flying machine, an adjustable surface, lines controlling said surface, connections between said surface and said lines

whereby movements of said lines are multiplied when transmitted to said surface, and means for balancing strains upon said lines.

26. In a flying machine, a pair of adjacent surfaces, a second pair of adjacent surfaces arranged above said first pair, links connecting said upper surfaces and said corresponding lower surfaces, and a flexible connection between said supper surfaces.

27. In a flying machine, pairs of similar surfaces, said pairs being superposed, links connecting corresponding surfaces of each of said pairs, a flexible connection between the upper of said surfaces, a steering mechanism, and lines connecting said steering mechanism and said upper surfaces, whereby said upper surfaces can be simultaneously tilted and moved bodily with respect to said lower surfaces, in opposite directions, and in the same direction.

28. In a flying machine, a surface, and pivoted links supporting said surface, said links being of different lengths.

29. In a flying machine, a frame, links in part comprising said frame, said links being of different lengths and being all pivotally mounted.

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

MALCOLM GROVER ADAMS.

Witnesses:

LEILA L. WILSON,

E. M. SWATSZEL.