J. L. WALKER.

FLYING MACHINE.

APPLICATION FILED AUG. 26, 1910.

995,819.

Patented June 20, 1911.

4 SHEETS—SHEET 1.

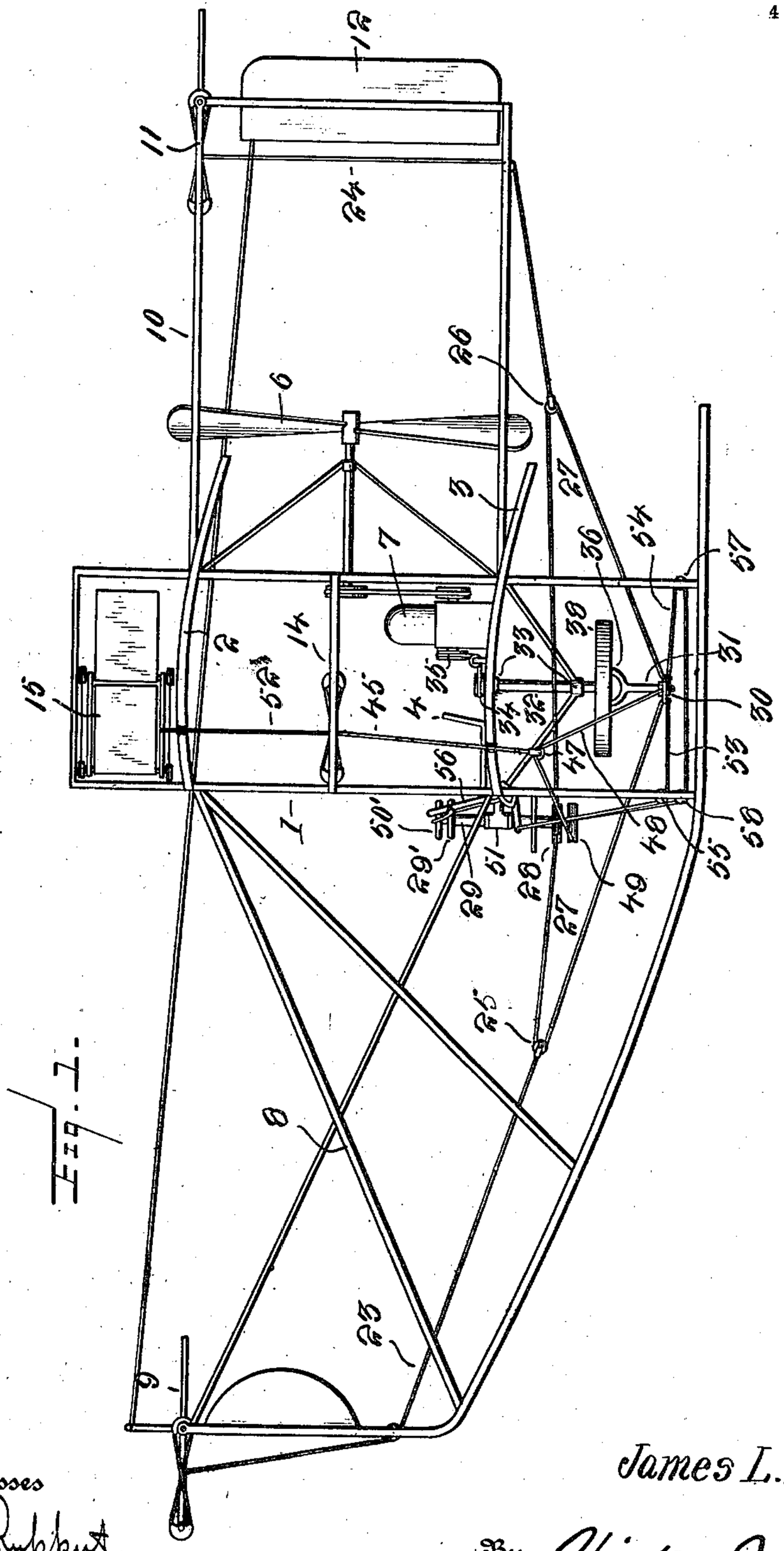

Fig. 1.

Witnesses

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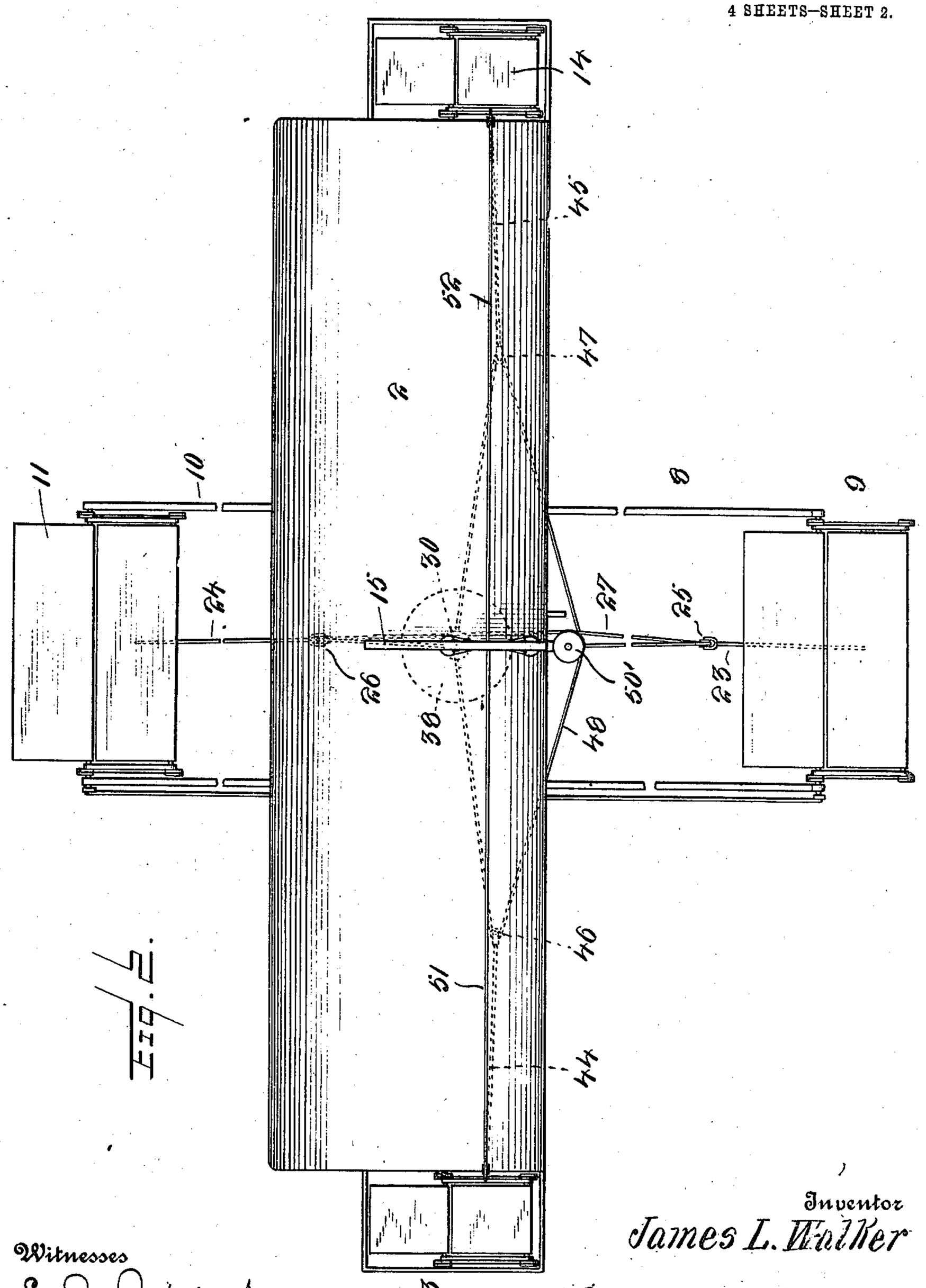

Fig. 2.

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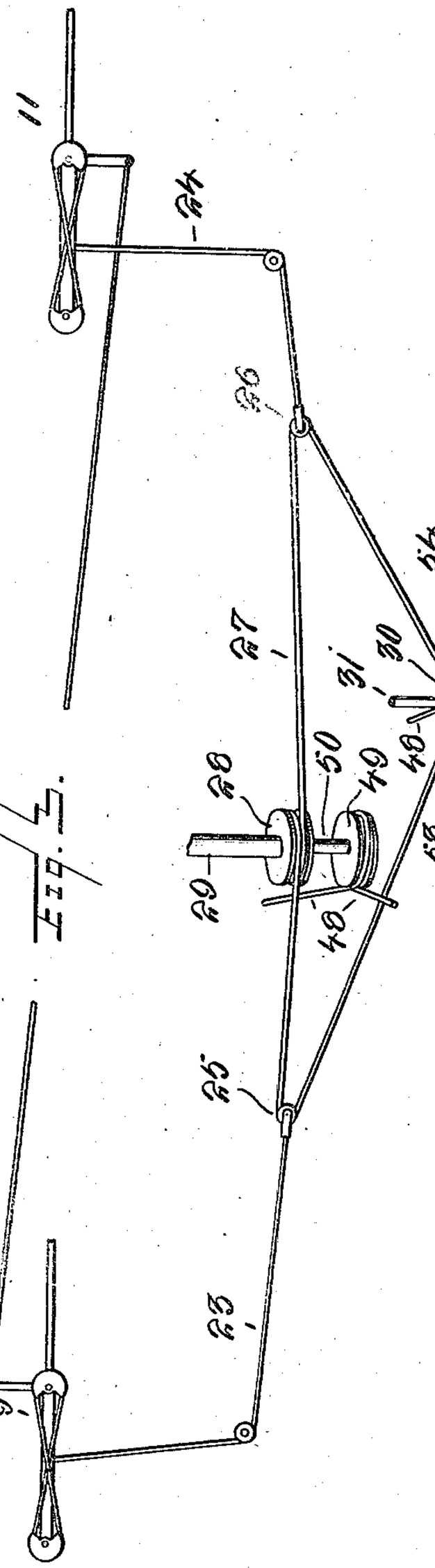
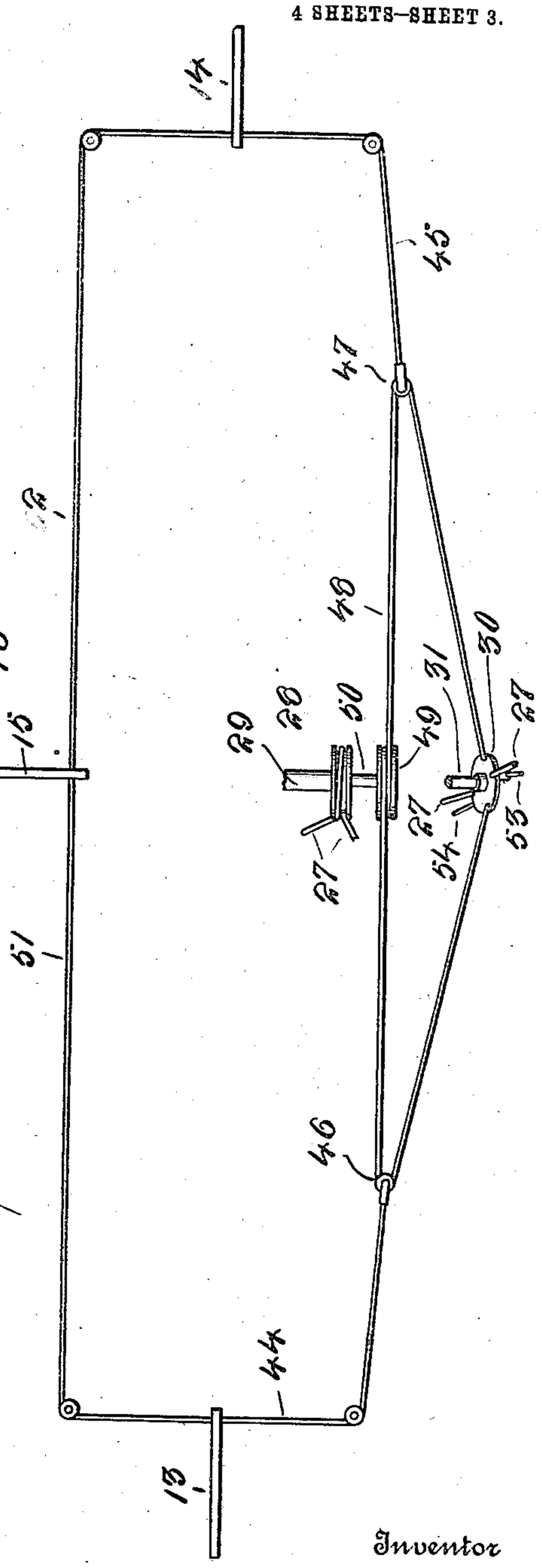


Fig. 4.



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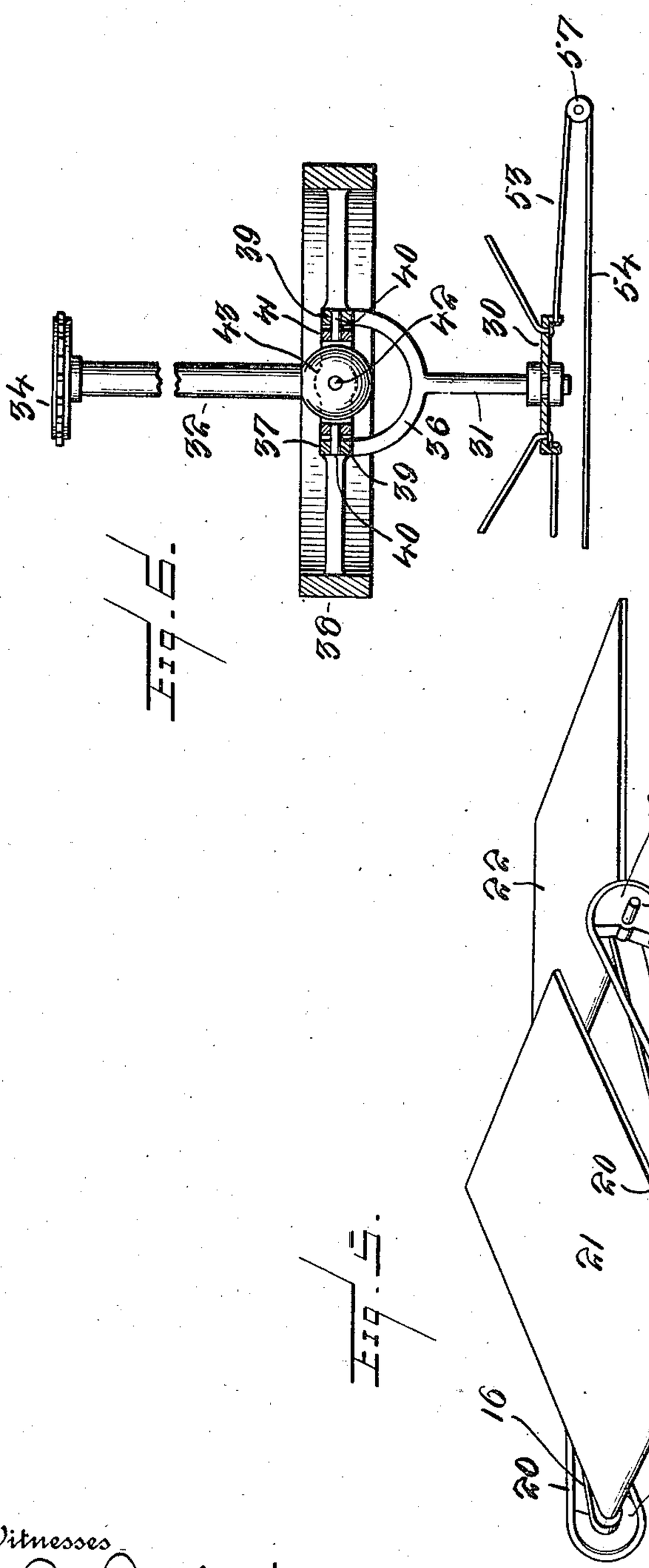

Fig. 5.

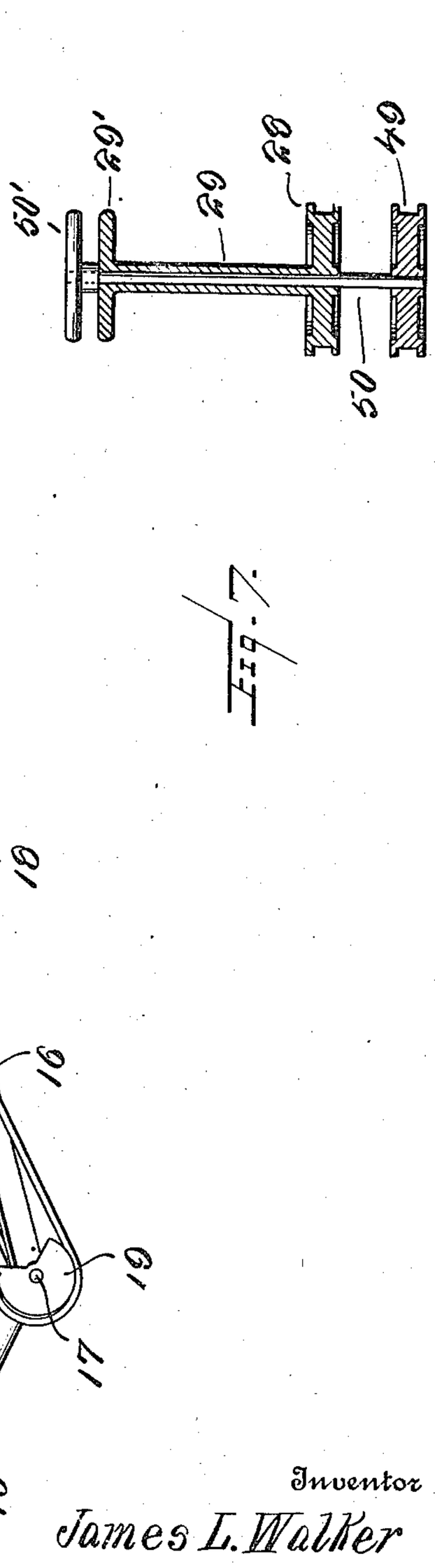

Fig. 7.

Fig. 4.

Witnesses

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UNITED STATES PATENT OFFICE.

JAMES LESTER WALKER, OF EAGLE POINT, OREGON.

FLYING-MACHINE.

995,819 Specification of Letters Patent. Patented June 20, 1911.

Application filed August 26, 1910. Serial No. 579,008.

To all whom it may concern:

Be it known that I, JAMES L. WALKER, a citizen of the United States, residing at Eagle Point, in the county of Jackson and State of Oregon, have invented new and useful Improvements in Flying-Machines, of which the following is a specification.

This invention relates to flying machines of the heavier-than-air type, one object of the invention being to provide simple and effective automatically operated means for securing lateral and longitudinal stability, which means may also be manually operated for maintaining the equilibrium of the machine and for steering and banking the machine in making a turn.

A further object of the invention is to provide a novel construction and arrangement of ailerons for controlling the lateral balance and a laterally adjustable fin normally operating to prevent lateral deflection of the machine from its course and operable in conjunction with the ailerons to control the turning movement of the machine in either direction.

A still further object of the invention is to provide a novel construction of gyroscope for automatically controlling the balancing devices, and means for rendering the gyroscope inoperative at any time so that the balancing devices may be manually controlled.

A still further object of the invention is to provide balancing rudders of a type which automatically equalize the pressure of the air upon the surfaces thereof to maintain the rudder in a determined position of adjustment.

With these and other objects in view, the invention consists of the features of construction, combination and arrangement of parts, hereinafter fully described and claimed, reference being had to the accompanying drawings, in which:—

Figure 1 is a side elevation, showing the application of the invention to a machine of the biplane type. Fig. 2 is a top plan view of the same. Fig. 3 is a diagrammatic view in perspective, showing the devices for securing longitudinal stability. Fig. 4 is a similar view, showing the devices for securing lateral stability. Fig. 5 is a perspective view of one of the balancing rudders, illustrating the pressure-equalizing action of the wings or sections thereof. Fig. 6 is a sectional elevation of the gyroscopic controlling device. Fig. 7 is a similar view of the operating elements for manual control.

Referring to the drawings, 1 designates the main frame of a flying machine of the biplane type, to which the invention is shown in the present instance applied, although it is to be understood that it is not limited in application thereto, as the essential features of the invention may be employed with equal efficiency upon other mutiplane machines or upon monoplane machines. In the illustration, 2 and 3 designate the upper and lower supporting planes or surfaces of the machine, 4 the pilot's seat, 6 the propeller, and 7 the driving motor, all of which may be constructed and arranged in any suitable manner.

Extending from the front of the main frame is a framework 8 supporting a horizontal rudder 9, and extending from the rear of the main frame is a framework 10 supporting a similar horizontal rudder 11, below which latter is arranged a vertical rudder 12 which may be operated by a suitable manually-controlled connection for steering the machine under normal service in a horizontal plane. The rudders 9 and 11 are connected for movement in opposite directions in unison, as hereinafter described, for steering the machine vertically and balancing the same longitudinally.

Arranged at or near the lateral margins of the supporting planes or surfaces 2 and 3, and preferably on a line between said planes in a biplane structure and below the level of the supporting surface in a monoplane structure, are lateral balancing rudders or ailerons 13 and 14 which are normally disposed in a horizontal plane or substantially so and connected for movement in unison in opposite directions.

Disposed above the upper supporting surface 2 at a point substantially midway between its lateral margins and normally extending in a vertical plane coincident with the central longitudinal line of the machine is a laterally movable stability fin or plane 15. This plane or fin, in its normal position, tends to prevent lateral deflection of the machine from its course, and is movable in reverse direction simultaneously with the ailerons to assist in maintaining lateral stability and to facilitate the banking of the machine in making a turn. The fin is so

connected up for operation with the ailerons as to present its resisting surface toward that side of the machine at which the aileron is depressed, or toward the aileron presenting the lesser angle of incidence, to retard the forward movement of the depressed side of the machine and thereby counteract the tendency to the retardation of the forward movement of that side of the machine at which the aileron is elevated, and which describes the larger arc in the turning movement.

The rudders 9, 11, 13, 14 and 15 are similar in construction to each other, such rudders differing only in their mode of mounting to the extent that the rudders 9, 11, 13 and 14 are mounted to swing vertically on horizontal axes, while the rudder 15 is mounted to swing laterally on a vertical axis. Each rudder consists of a frame formed of side pieces 16 connected by front and rear transverse shafts 17 and 18, the ends of which project beyond the frame pieces and carry mutilated pulleys 19, the front and rear pulleys at each side of the frame being connected by a crossed belt 20. The body of the rudder is composed of two vanes, planes or sections 21 and 22, the forward vane 21 being fixed at its front edge to the shaft 17 and being of a proper size to fold or swing between the side pieces 16, while the vane 22 extends beyond the frame and is rigidly connected at its forward edge to the shaft 18. Under normal conditions the two vanes lie in longitudinal alinement and form in effect a single surface for the pressure of the air thereon. If, however, either vane or section of the rudder is subjected to a greater pressure than the other section, it will be shifted at an angle in the direction toward which the air current flows and will at the same time transfer motion through the connecting gearing to the other plane, which will be shifted to a corresponding angle in the reverse direction, thus equalizing the pressures upon the surfaces of the vane in an obvious manner.

Connected at their outer or upper ends to the frame portions of the respective vanes 9 and 11, at points in advance of the shafts 18, which are journaled at their ends in the frame structures 8 and 10, and thus form the horizontal axes on which said vanes swing, are controlling cords or wires 23 and 24 which extend downwardly and inwardly toward the main frame over suitable guide pulleys and carry at their lower free ends pulleys 25 and 26 around which pass a looped cord or wire 27. One stretch of this cord or wire 27 is wound in opposite directions around a drum or pulley 28 on a shaft 29, while the ends of the cord or wire forming the opposite stretch thereof are connected at diametrically opposite points to a disk or head 30 forming a floating bearing for the lower end of a shaft or stem 31, journaled to turn loosely therein. The shaft 31 forms one section of the divided shaft of a gyroscopic controlling device, the other or upper shaft section 32 of which is journaled to rotate in fixed bearings 33 on the main frame of the machine and carries at its upper end a sprocket wheel or pulley 34 by which it is driven by a chain or belt 35 from the driving motor 7 or any other suitable driving device, by which the gyroscope is constantly driven while the machine is in flight. The shaft section 31 is provided at its upper end with a yoke 36 rigid with the ring-like hub 37 of the gyroscope wheel 38, which hub is provided at diametrically opposite sides with bearings 39 in which are journaled trunnions 40 projecting from a bearing ring 41 inclosed by the hub, whereby the shaft section 31 and wheel 38 are adapted to have tilting motion in one direction. The ring 41 is formed at right angles to its trunnions 40 with bearing openings receiving trunnions 42 projecting from a ball or approximately circular head 43 fixed on the lower end of the shaft section 32, whereby the shaft section 31 and wheel 38 are adapted to have tilting motion in a direction at right angles to the tilting motion above described. This construction provides a gimbal joint connection between the stationary or fixed shaft section 32 and the gyroscope wheel and swinging shaft section 31, by which relative tilting motion between said fixed and swinging sections is permitted both longitudinally and laterally of the machine, allowing the shaft section 32 to tilt in both general directions with the machine while the shaft section 31 remains perpendicular through the action of the gyroscope wheel 38.

Connected at their outer ends with the frame portion of the respective ailerons 13 and 14 in advance of their fulcrum shafts 18 are controlling cords or wires 44 and 45 which extend downwardly and inwardly to the main frame over suitable guide pulleys and are provided at their inner or free ends with pulleys 46 and 47 around which pass a looped cord or wire 48. One stretch of this cord or wire 48 is wound in opposite directions around a drum or pulley 49 on a shaft 50, while the free ends of the cord or wire forming the opposite stretch thereof are connected with the head or disk 30 at diametrically opposite sides thereof and at right angles to the points of connection of the ends of the cord or wire 27. The shaft 29 is hollow and is journaled upon the shaft 50 and is itself journaled in a suitable bearing 51 on the frame of the machine adjacent the pilot's seat 4, said shafts being respectively provided with hand wheels 29′ and 50′ by which they may be operated to control the respective cords or wires 27 and 48 and

thereby manually operate the horizontal rudders and ailerons. Leading from the respective ailerons 13 and 14 are cords or wires 51 and 52 which pass over suitable guide pulleys and are connected with opposite sides of the frame portion of the stability rudder or fin 15 at a point in advance of its fulcrum shaft, whereby said rudder will be adjusted in the manner before described with the ailerons. Secured to the head or disk 30 at their lower ends are cords or wires 53 and 54, which are attached to diametrically opposite sides of said head. The cord 53 extends upwardly and forwardly over a guide pulley 55 to one of the arms of a bell crank lever 56 mounted on the main frame, while the cord or wire 54 extends rearwardly and over a guide pulley 57 and thence forwardly and upwardly over a guide pulley 58 and is similarly connected with the lever 56, the said cords forming a looped flexible connection which is normally slack and permits the movable member of the gyroscope to have universal motion under the tilting movements of the vessel, but which is adapted to be drawn taut by adjustment of said lever 56 to hold the head 30, and consequently the movable member of the gyroscope, fixed with relation to the main frame, so that at any time the gyroscope may be thrown out of action as respects its control of the horizontal rudders and ailerons for the automatic operation of the same. The lever 56 is provided with suitable means for locking it in its two positions of adjustment.

In the automatic control of the horizontal rudders 9 and 11, assuming the cords 53 and 54 to be slack, it will be understood that the drum 28 forms a fixed point separating the cord 27 into sections connected with the respective rudders and the floating bearing head 40. Hence, when the machine tilts upwardly and rearwardly, the section of the cord 27 connected with the rudder 9 will be drawn upon to depress the forward end of said rudder, while the section of the cord 27 connected with the rudder 11 will be slackened, allowing said rudder to be removed in the reverse direction by the pressure of the air, so that by the downward pressure of the air on the rudder 9 and the upward pressure of the air on the rudder 11 the longitudinal balance of the machine will be restored. Similarly in the automatic control of the ailerons 13 and 14 to maintain the lateral balance the drum 49 will serve as a fixed point separating the cord 48 into sections respectively connected with the ailerons and the floating bearing head 30, so that when the machine tilts in one direction or the other the section of the cord 48 connected with the aileron on the ascending side will be drawn upon to pull such aileron down, while the section of the cord 38 connected with the aileron on the depressed side will be slackened, allowing the aileron to be forced upward by the air pressure, the reverse pressures of the currents of air on the two ailerons thus serving to restore the normal lateral balance.

Under the conditions above mentioned it will be apparent that the rudders and ailerons will be solely under the automatic control of the gyroscope, as the cords 27 and 48 cannot be operated by the actuation of the drums 28 and 49 since a pull upon either of said cords will result simply in imparting a swinging motion therethrough to the movable section of the gyroscope. By, however, adjusting the lever 56 to make the connection 53—54 taut, the head 30 and movable section of the gyroscope will be fixed against movement relative to the frame of the machine and will constitute a fixed point to which the ends of the cords 27 and 48 are connected, allowing the sections of either cord connected with the drum of its manually controlled operating shaft to be respectively taken up and paid out to pull upon the connection leading to one of the rudders or ailerons and simultaneously slacken the connection leading to the other rudder or aileron, allowing the pilot to have complete manual control for balancing the machine laterally and longitudinally and steering the machine both vertically and horizontally. It will thus be seen that while the balance of the machine will normally be automatically preserved in flight to the action of the gyroscope, the operator may at any time assume complete control for steering and taking care of any extraordinary contingencies which may arise.

Having thus described my invention, I claim:—

1. In a flying machine, the combination of a frame carrying a supporting surface, balancing devices, a gyroscope including a gravity-controlled pendulum rotatable therewith, a head swiveled to the pendulum, connections between the head and balancing devices for operating the latter under the swinging movements of the pendulum, means operative upon the head to hold the pendulum from movement, and manually controlled means for actuating said operating connections when the pendulum is held from swinging movement.

2. In a flying machine, the combination of a frame carrying a supporting surface, balancing devices, a gyroscope including a gravity-controlled swinging pendulum rotatable therewith, a member swiveled to the pendulum, a looped, flexible operating element connected with said member, connections between said looped element and the balancing devices, said element having a running engagement with said connections, means for holding the swiveled member from movement to stay the swinging mo-

tion of the pendulum, and manually operable controlling means engaging the looped flexible connections.

3. In a flying machine, the combination of a frame having a supporting surface, pivotally mounted balancing rudders, a gyroscope including a swinging member influenced by the tilting of the machine, a head swiveled to said swinging member, a looped, flexible operating element connected by one of its stretches to the head, a winding drum connected with the other stretch of the operating element, flexible connections having pulleys engaging the operating element and leading to the balancing devices, and means under control of the operator and connected with the head for holding the pendulum against swinging movement.

4. In a flying machine, the combination of lateral and longitudinal balancing devices, a gyroscope including a pendulum influenced by the tilting of the machine, a head swiveled to the pendulum, looped, flexible operating elements, each connected by one of its stretches with the head, manually operable winding drums connected with the opposite stretches of the respective flexible operating elements, flexibly controlled connections leading from the lateral balancing devices and having a running connection with one of said flexible operating elements, and flexible connections leading from the longitudinal balancing devices and having a running connection with the other flexibly operating elements.

5. In a flying machine, a rudder comprising an open frame, transverse shafts journaled at the front and rear of the frame and projecting at their ends beyond the same, a front vane adapted to fold within the frame, and connected at its forward end to the front transverse shaft, a second vane extending rearwardly from the frame and connected at its forward end to the rear transverse shaft, pulleys upon the extended ends of the shafts, and crossed belts connecting the pulleys at each side of the frame, whereby when one vane is moved by air pressure in either direction the other vane will be simultaneously adjusted to the same degree in the reverse direction.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES LESTER WALKER.

Witnesses:

C. S. PAINTER,

FRED PETTIGREW.