

A. G. WATKINS.
FLYING MACHINE.

APPLICATION FILED FEB. 24, 1912.

Patented Dec. 17, 1912.

2 SHEETS—SHEET 1.

1,047,865.

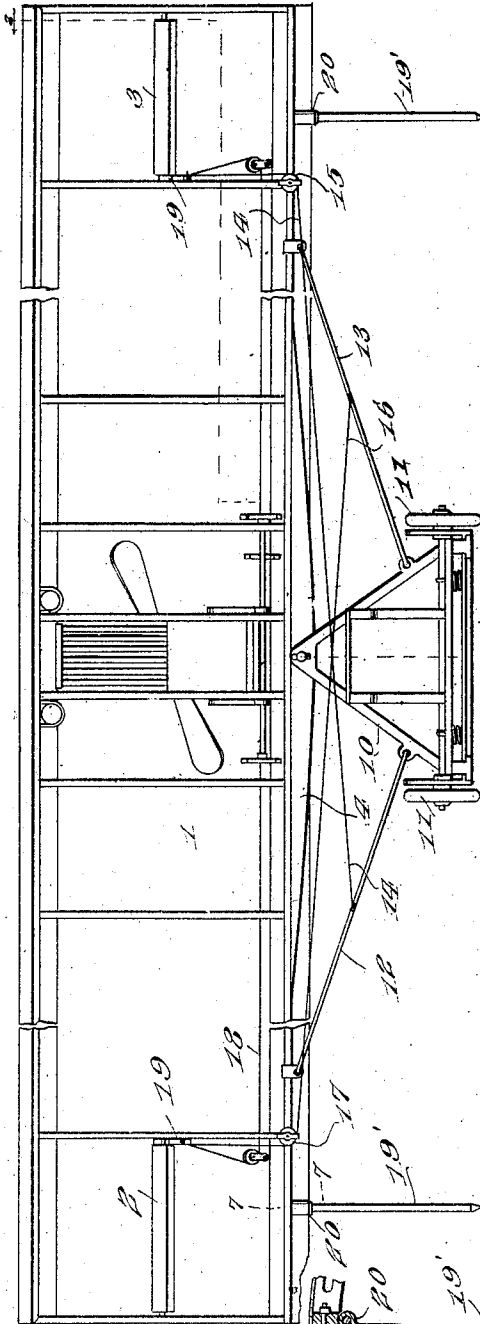


Fig. 1.

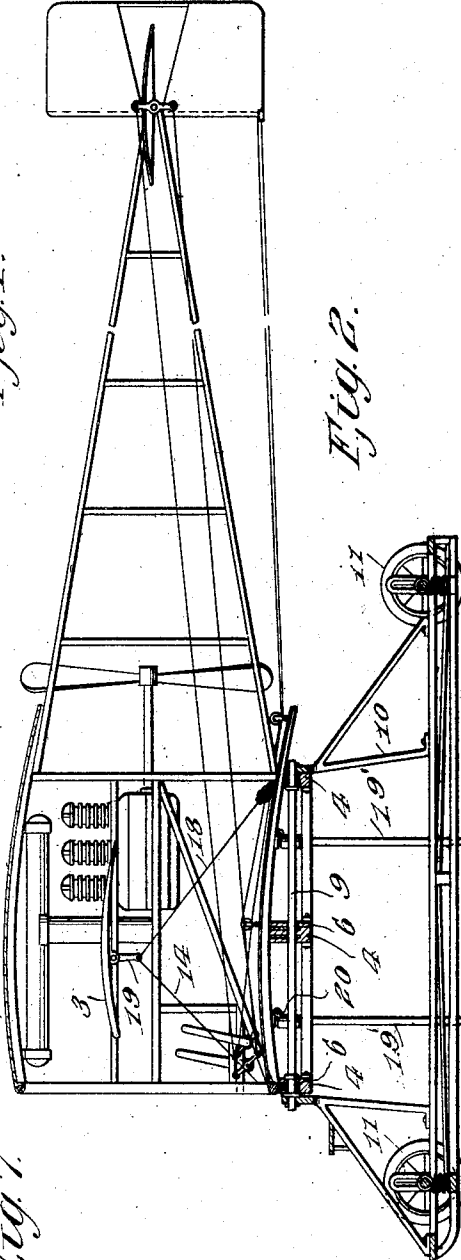


Fig. 2.

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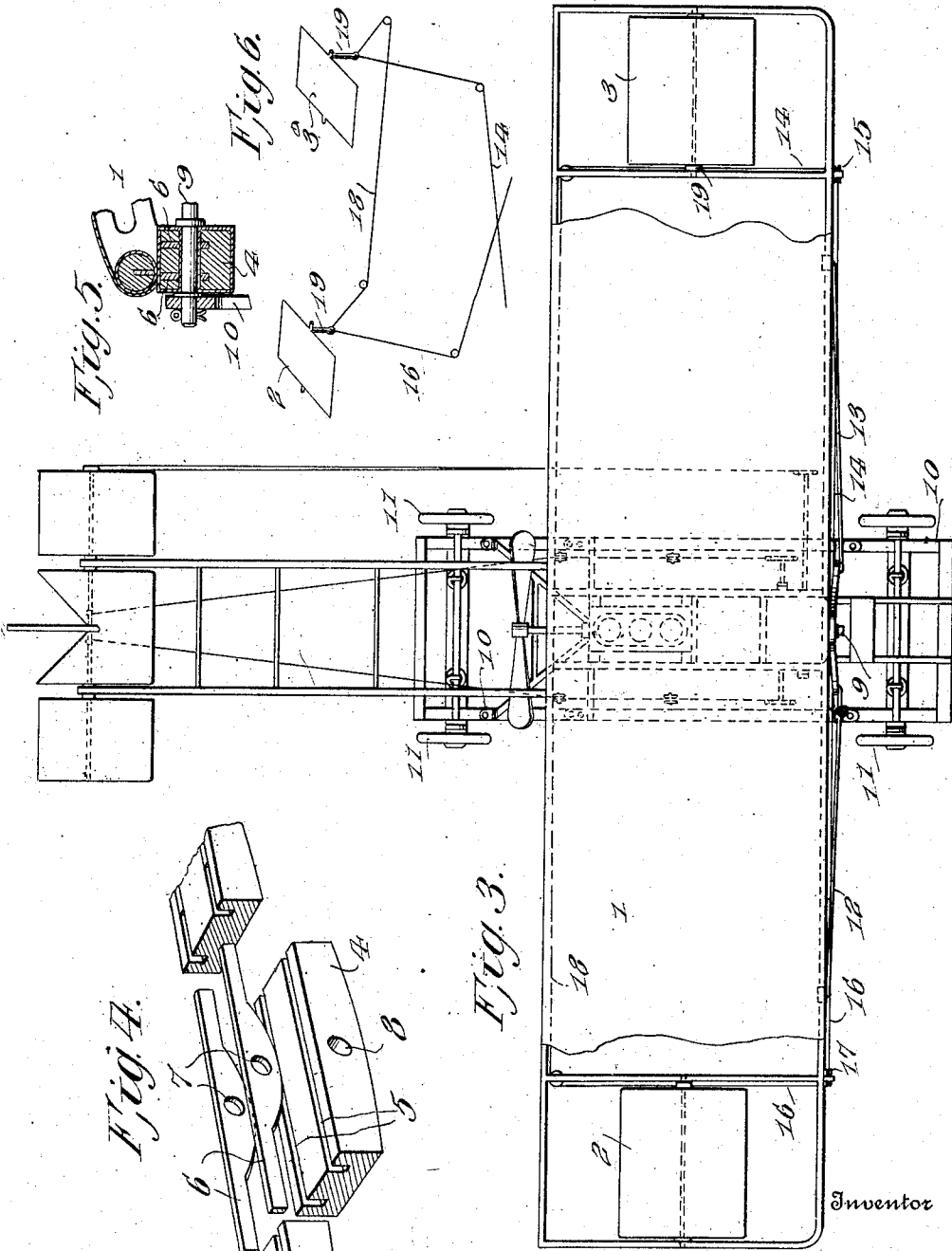
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UNITED STATES PATENT OFFICE.

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FLYING-MACHINE.

1,047,865.

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To all whom it may concern:

Be it known that I, ARTHUR G. WATKINS, a citizen of the United States, residing at Mechanicsburg, in the county of Cumberland and State of Pennsylvania, 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 class, and particularly to means for automatically maintaining the lateral stability of such machine.

The object of the invention is to provide a machine in which the body of the machine, including the supporting surface, is pivotally mounted upon its carriage or chassis, whereby the latter is adapted to serve as a stabilizing pendulum, suitable connections between said body and carriage being provided, whereby the lateral swing of the body in either direction is limited and the body controlled to automatically restore and maintain its lateral equilibrium.

A further object of the invention is to provide a machine structure of the character described in which the controlling connections between the body and carriage are adapted to oppose a yielding resistance to a pivotal motion of the body in either direction, and in which coöperating means controlled by said connections are employed to return the body to a balanced position.

A still further object of the invention is to provide fenders for supporting the body against tilting motion beyond a predetermined extent when the machine is upon the ground, which fenders are adapted to yield to permit the body to swing to a sufficient extent to compensate for jars, vibrations, etc.

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 front elevation of a flying machine of the biplane type embodying my invention. Fig. 2 is a central vertical longitudinal section of the same on the line 2—2 of Fig. 1. Fig. 3 is a top plan view of the machine with portions broken away to disclose the balancing devices. Fig. 4 is a fragmentary sectional perspective view of one of the bed rails, showing the reinforcing plates removed therefrom. Fig. 5 is a detail

longitudinal section through the foremost bed rail, lead edge of the supporting surface and the adjacent portion of the carriage. Fig. 6 is a diagrammatic view of the balancing device and controlling cables. Fig. 7 is a detail section on the line 7—7 of Fig. 1, showing the mode of mounting one of the supporting fenders.

In the illustrated embodiment I have shown the application of the invention to a biplane structure, although it is to be understood that it may be applied to other multiplane structures or to machines of the monoplane type.

Referring to the drawings, 1 designates the body of the machine, including the main frame and supporting surface or surfaces, which body is provided on opposite sides of its longitudinal center with balancing devices 2 and 3, herein shown in the form of ailerons, although other suitable balancing agents may be employed.

Secured to the underside of the frame of the body is a series of, preferably three, bed rails 4, which are arranged equidistantly between the fore and aft edges of the body in parallel relation. Each of these bed rails is preferably made of a body of wood having strength and lightness and provided with grooves or recesses 5 in which are fitted reinforcing plates 6. These plates are secured in position in any suitable manner and are provided with central enlargements, through which enlargements and the center of the body of the rail are formed registering openings 7 and 8. In practice, after the strips are secured in position, each bed rail is preferably given a coat of bronze and then provided with a film of copper by electro-deposition, so that the strip will be reinforced against transverse strains and provided with a surface coating which will be ruptured whenever the rail is split or broken, to give visual evidence of such fact. The reinforcing strips in the bed rails are so disposed that the force or pressure to which the strips are subjected when in use will act in a direction toward the longitudinal edges of the strips, and since such a force or pressure will have a tendency to tear rather than bend the strips, a maximum reinforcing action is obtained.

The openings 7 and 8 in the reinforcing strips and bed rails are provided for the

passage of a longitudinally extending shaft 9 mounted upon the apex of a substantially triangular carriage or chassis 10, whereby the body as a whole is pivotally mounted upon a horizontal longitudinal axis to tilt vertically in either direction laterally, the diverging or sloping sides of the carriage permitting the body to have a determined range of pivotal motion. The carriage or chassis is provided with suitable cushioned launching and landing wheels 11, and is adapted when the machine is in flight to normally maintain a position perpendicular to the earth's surface, and to thereby perform the function of a pendulum weight or lever to control the pivotal motion of the body and maintain the lateral stability thereof through suitable connections, which I will now proceed to describe.

Extending from the right and left hand sides of the carriage and connecting the same with the corresponding sides of the body are flexible controlling cables or connections 12 and 13, which are coupled at their inner ends to the body at points between the base and top thereof and thence incline laterally outwardly and upwardly and are attached at their outer ends to the body at suitable points between the axis 9 and the lateral margins of the body, whereby the swinging motion of the body is controlled. Preferably these cables or connections are made in the form of elastic ropes or springs, normally held under slight tension, so that when the body tilts laterally in either direction the cables at the descending side will, through the arc of motion of their outer ends, which will be eccentric to the axis of motion of the body 1, be placed under a constantly increasing tension, whereby said cables will be caused to set up a resistance to the tilting of the body and limit its tilting motion to a determined extent, as will be readily understood.

It will be understood from the foregoing description that as either side of the body is forced upward by excess air pressure or by a decrease in the supporting effect of the air on the opposite side of the body, the cables at the lifting side will be placed under tension and operate to oppose a determined resistance to the tilting of the body, which will be all that is necessary under normal conditions to prevent the body from tilting laterally to an excessive degree and to return it to its normal position whereby an automatic equilibrium will be maintained. In order, however, to render the balancing action more certain and effective and to provide for a balancing action under abnormal conditions, the balancing devices 2 and 3 are suitably coupled to the connections 12 and 13 so as to be operated thereby when the body tilts to cooperate therewith in effecting a return of the body to a state of equilibrium. As

shown, suitable connections 14 lead from the cables 12 at the right hand side over guide pulleys 15 to the balancing device 3 at the left hand side, while similar connections 16 extend from the cables 13 at the left hand side over suitable guide pulleys 17 to the balancing device 2 at the right hand side. These connections 14 and 16, which may be in the form of wires or cables, cross and extend at an intermediate point transversely of the carriage, but out of contact therewith so as to avoid interference in the shifting of the parts. A wire or cable 18 also connects the two balancing devices for movement in unison, so that when one is positively operated in one direction the other will be actuated thereby to move in the reverse direction. The cables 14, 16 and 18 are coupled to crank arms 19 carried by the balancing devices, which latter normally lie at a negative angle of incidence and are pivotally mounted in advance of their transverse centers in such manner that a pivotal motion of either balancing device in which its forward edge moves upwardly and its rear edge moves downwardly will increase the angle of incidence thereof to secure a lifting effect, while a reverse motion of the balancing device will position it for a depressing effect.

It will be observed that the arrangement of the cables 16 is such that when the cables 13 are tensioned to a certain degree by the upward movement of the left hand side of the body, said cables 16 will be drawn upon to adjust the balancing device 2 for a lifting action, while at the same time the cables 14 will slacken with the cables 12, to allow the balancing device 3 to be adjusted for a depressing effect, which will be accomplished by the pull thereon from the cable 18 tensioned by the adjustment of the balancing device 2. On the other hand, when the cables 12 are tensioned to a certain degree by the upward movement of the right hand side of the body, the cables 15 will be tensioned and caused to adjust the balancing device 3 for a lifting action, while the cables 13 and 16 will slacken to permit the balancing device 2 to be adjusted for a depressing effect, which will be accomplished through the tensioning of the cable 18 by the balancing device 3. Hence when the machine tilts laterally in either direction, the controlling cables connecting the carriage with the lifting side of the machine will oppose a resistance to such motion of said machine and tend to draw it backward to normal position, while at the same time, when such tilting motion of the machine tensions said controlling cables to a predetermined degree, the operating wires or cables associated therewith will be actuated to adjust the balancing device at the ascending side for a depressing effect and the balancing device at the

at the descending side for a lifting effect, whereby the balance of the machine will be automatically restored and maintained.

In practice, suitable means for manually controlling the balancing devices may be employed, but I have not deemed it necessary to show the same, as it constitutes no part of the present invention. The machine may be equipped with any desired type of propelling mechanism and power plant and suitable vertical and horizontal rudders, controlled by any preferred type of controlling mechanism. Also the parts may be varied in form, character and arrangement as circumstances may require in the application of the invention to different types of machines. These and other modifications are held to fall within the spirit and scope of the invention.

In order to prevent undue lateral motion of the supporting surface from shocks, jars or vibrations, I provide at each end or lateral margin of the body one or more fenders 19. These fenders, which may consist of rods or bars, are pivotally attached to the body, as at 20, to swing rearwardly from a normally perpendicular position, stop surfaces 21 and 22 on the fender and body being provided to prevent the fender from swinging forward beyond a perpendicular position. When the machine is at rest and the body normally horizontal, the fenders stand vertical and support the ends of the body and hold the same from tilting motion. When the machine is in motion on the ground, during the act of launching or landing it, the fenders drag along the ground surface and prevent the body from tilting unduly under the running shocks and jars. If the machine should tilt in either direction, the fender at the descending side is permitted by its pivotal mounting to swing rearwardly at a sufficient angle to prevent damage to the parts, while at the same time opposing a resistance to the depression of such side of the machine beyond a predetermined extent.

Having thus described the invention, what I claim as new is:

1. In a flying machine, the combination of a body, a carriage, said body and carriage being pivotally connected to swing laterally with relation to each other, balancing devices upon the body, elastic connections between the carriage and the body for limiting the swinging motions of the latter, and flexible connections between the first named flexible connections and the balancing devices for controlling the latter when the body swings out of laterally balanced position.

2. In a flying machine, the combination

of a body, a carriage, said body and carriage being pivotally connected to swing laterally with relation to each other, balancing devices upon the body, elastic connections between the carriage and opposite sides of the body for controlling the pivotal motions of the latter, and flexible connections between the balancing devices and elastic connections and adapted to be tensioned when the elastic connections are tensioned to a determined degree for adjustment of the balancing devices, when the body moves out of a laterally balanced position to a predetermined degree.

3. In a flying machine, the combination of a body, a carriage, said body and carriage being pivotally connected for lateral swinging movements with relation to each other, balancing devices upon the body, elastic controlling connections between the sides of the carriage and opposite sides of the body and adapted to be tensioned by the swinging movements of the body to limit such movements thereof, and flexible connections leading from the balancing devices to said elastic connections, the flexible connection from the balancing device at each side of the body being coupled to the elastic connection at the opposite side of the body, said flexible connections being tensioned when said elastic connections are tensioned to a predetermined degree to adjust said balancing devices.

4. In a flying machine, the combination of a body, balancing devices upon the body, bed rails secured to the under side of the body and each having a reinforcing plate embedded therein and extending edgewise in a vertical direction, a pivot bolt passing through the bed rails and reinforcing plates, a carriage pivotally mounted upon said bolt, so as to permit the body to swing laterally with relation thereto, and controlling connections between the carriage and body.

5. In a flying machine, a carriage, a body pivoted to tilt laterally thereon, elastic cables connecting the carriage with the opposite sides of the body and adapted to be respectively tensioned by the upward motion of the adjacent side of the body to limit the swinging motion of the body, lateral balancing devices upon the body, and connections between the first-named connections and the balancing devices for adjusting the latter when the body tilts to restore the same to a balanced position.

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

ARTHUR G. WATKINS.

Witnesses:

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E. BRUCE TAYLOR.