

L. S. CUNNINGHAM.
FLYING MACHINE.
APPLICATION FILED FEB. 1, 1911.

1,032,744.

Patented July 16, 1912.

4 SHEETS—SHEET 1.

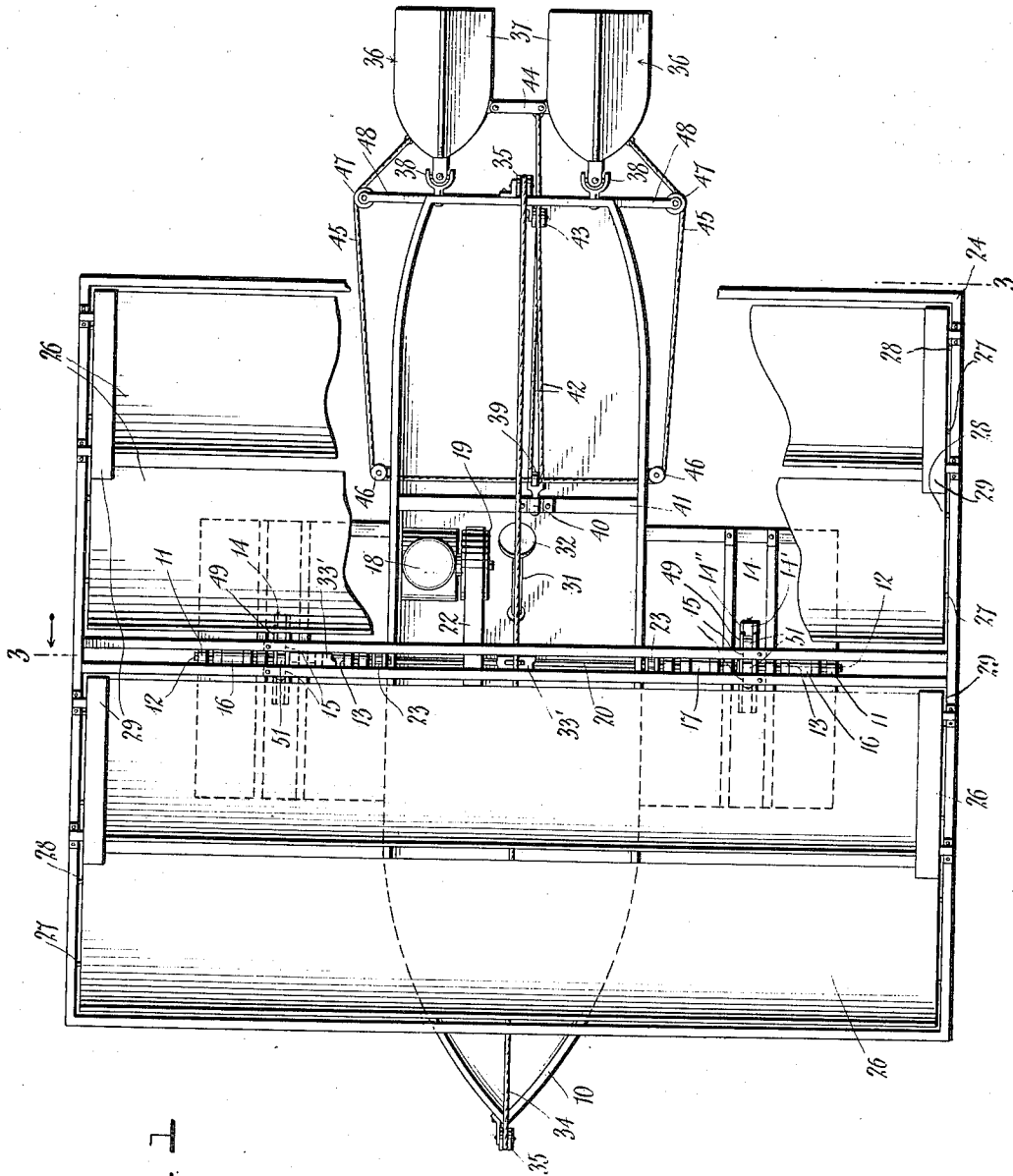


FIG. 1

Witnesses

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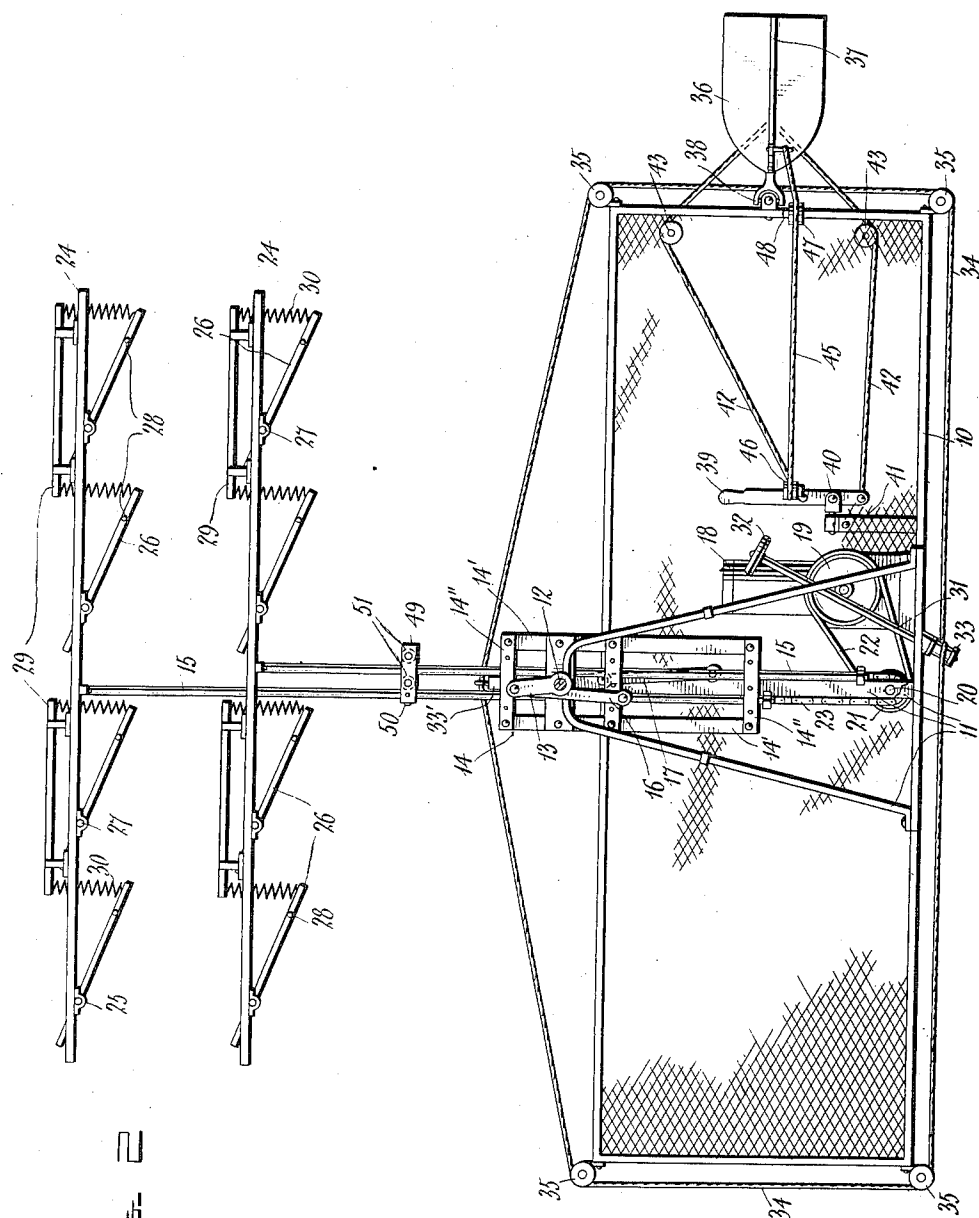


FIG. 2

Witnesses

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4 SHEETS—SHEET 3.

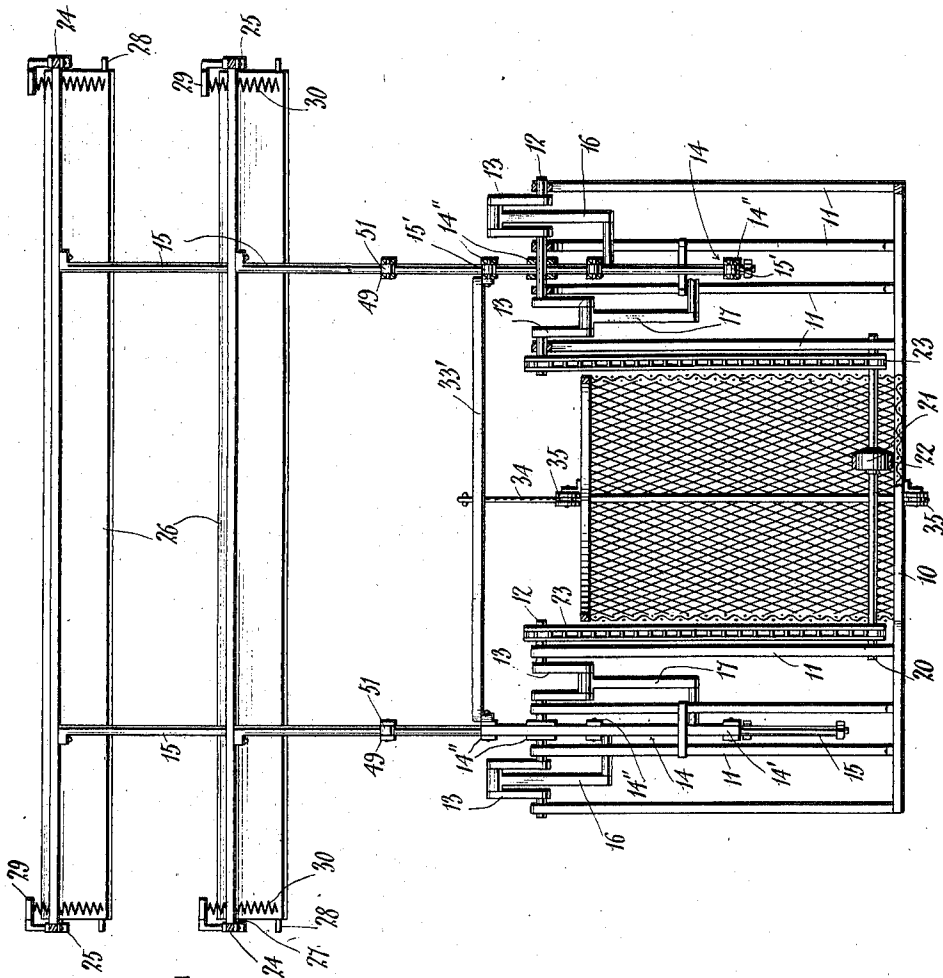


Fig. 3

Witnesses

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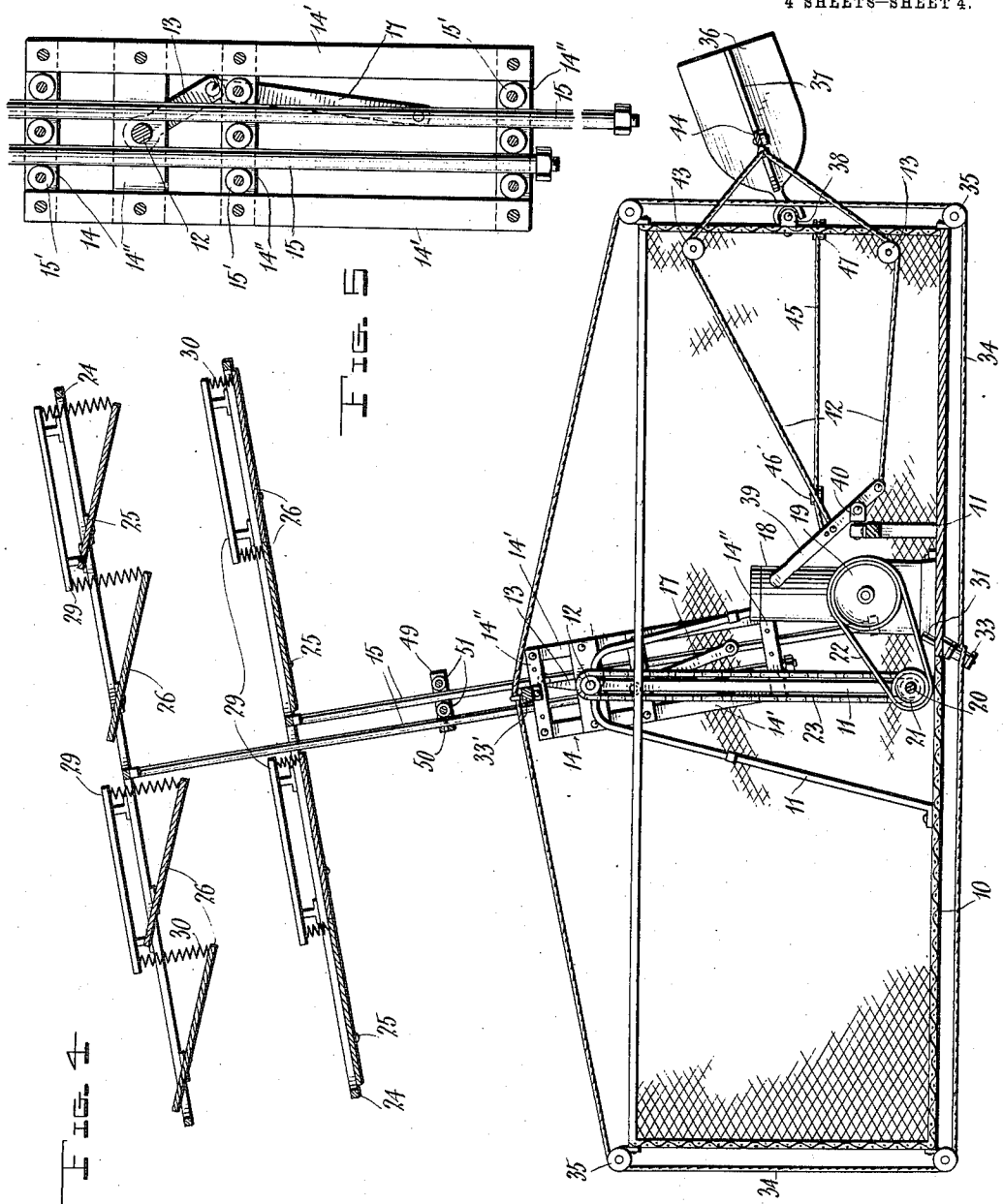
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4 SHEETS—SHEET 4.



Witnesses

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UNITED STATES PATENT OFFICE.

LEMUEL S. CUNNINGHAM, OF CLINTON, WASHINGTON.

FLYING-MACHINE.

1,032,744.

Specification of Letters Patent.

Patented July 16, 1912.

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To all whom it may concern:

Be it known that I, LEMUEL S. CUNNINGHAM, a citizen of the United States, residing at Clinton, in the county of Island, State of Washington, have invented certain new and useful Improvements in Flying-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to flying machines and has special reference to that type of heavier than air machine which is known as an ornithopter.

One object of the invention is to improve and simplify the general construction of devices of this character.

A second object of the invention is to provide a machine of this class wherein the reciprocating wing limits may be inclined forwardly or rearwardly so that the machine is not only lifted but also drawn in the desired direction.

With the above and other objects in view the invention consists in general of an ornithopter of novel construction provided with improved means for supporting and carrying reciprocating wings.

The invention further consists in certain novel details of construction and combinations of parts hereinafter fully described, illustrated in the accompanying drawings, and specifically set forth in the claims.

In the accompanying drawings, like characters of reference indicate like parts in the several views, and; Figure 1 is a plan view of a flying machine constructed in accordance with this invention, certain of the parts being taken away the better to show the remainder of the device. Fig. 2 is a side elevation through such a machine, the upper wing plane being shown at the start of the descending movement. Fig. 3 is a vertical longitudinal sectional view through the construction shown in Fig. 2, parts thereof being shown in elevation. Fig. 4 is a longitudinal section showing the upper wing plane approaching the end of its upper movement and the wings inclined forwardly. Fig. 5 is a longitudinal sectional view of one of the wing supporting frames.

The body of the machine is indicated at 10 and comprises a suitable frame work provided with housing to cover and protect the occupants. It is to be understood that this

frame work and housing can be arranged to suit the various uses and sizes of the invention and is to be taken as typical of any such body. Carried by the body 10 are bearing standards 11 and suitably journaled in the body sides and standards 11 are crank shafts 12 provided with oppositely disposed cranks 13, arranged in pairs. There is provided one pair of these crank shafts on each side of the body and substantially in the center thereof, the body being widened by lateral extensions at the center to enable it to support said shafts. Journaled on the crank shaft 12 are wing supporting frames 14 each comprising longitudinal bars 14' connected at intervals by transverse bars 14'', and on this wing supporting frame is a pair of reciprocating rods 15 spaced from each other by rollers 15' carried by the cross bars 14''. Connecting rods 16 connect the cranks on one side of the axis of said crank shafts with certain of the rods 15 while other connecting rods 17 connect the cranks on the other side of the axis with the other reciprocating rods. It will be observed that by means of this arrangement the rotation of the crank shafts will raise the rods to which the connecting rods 16 are attached at the same time that the reciprocating rods to which the connecting rods 17 are attached are lowered so that these rods reciprocate in opposite directions.

For the purpose of driving the crank shafts 12 there is provided a motor 18 of any suitable type having the usual belt wheel 19. Extending transverse the body is a drive shaft 20 provided with a belt pulley 21 connected by a belt 22 to the driving pulley 19. On the shaft 20 are suitable sprockets which are connected by sprocket chains 23 to other sprockets on the shafts 12. By this arrangement the operation of the motor alternately reciprocates the rods 15.

Carried on the ends of the members 15 are wing frames 24 which are preferably rectangular in shape and each of these wing frames is supported on a respective pair of the members 15, said members being attached centrally of the side members of the respective frames 24. On the under side of each of the frames 24 are bearing brackets 25 whereto are hinged wings 26, the said wings being provided with pintles 27 constituting hinge members and positioned nearer one transverse edge of each frame than another. Pins 28 project from the lateral edges of each wing and are so arranged that when

the wings are in the closed positions these wings will contact with the under sides of the respective frames 24 thus limiting the movement of said wings in one direction.

5 Spring bars 29 are supported on the frames 24 and springs 30 are connected at one end to these spring bars and at the other end to respective wings 26 so that the wings are normally held in the closed position.

10 Now it will be observed that when the shaft is rotated the wing frames 24 will be laterally drawn together and forced apart. As the frames move toward each other the lower wing frame rises and the upper one drops with the result that the resistance of the air on the wings of the lower frame causes said wings to open against the action of the springs 30 thus enabling said frame to rise freely while at the same time, the resistance of the air on the upper wings holds them closed and the machine is thereby

15 bodily lifted. When the wing frames are moving apart the upper wings yield and the lower wings act to lift the machine.

20 When the wing frames 24 are in a horizontal position the lift will be directly upward but if the rods 15 be inclined forward or backward the lift will be upward and in the direction of inclination of the rods 15 thus serving as propelling means as well as

25 lifting means. In order to incline the wing frames in this manner there is provided a shaft 31 which extends downward through the body of the car and has upon its upper end a hand wheel 32. On the lower end of this shaft is a drum 33 from which extend cables 34. These cables pass over suitable guide pulleys 35 and are connected to a bar 33' which is terminally fixed to the frames

30 14'. The cables 34 are so wound upon the drum 33 that one of these cables will be wound on the drum while at the same time the other cable will be unwound therefrom. By this means the rotation of the shaft 31

35 serves to pull open one of the cables 34 and release the other cable thus inclining the frame 14 and consequently the wing frames, according to the direction of rotation of the hand wheel 32.

40 For the purpose of steering the device there is provided a pair of rudders having vertical blades 36 and horizontal blades 37 these rudders are connected by a universal joint 38 to respective corners of the rear end of the body. At 39 is a steering lever which is universally joined as at 40 to a bracket 41 supported by the body and from this lever extend forward steering ropes 42 attached to the lever on opposite sides of its pivot

45 and leading from guide pulleys 43 to a cross bar 44 connecting the rudders. Other steering ropes 45 are attached to the lever 39 and extend laterally away therefrom. The last mentioned steering ropes are led

50 over suitable guide pulleys 46 and extend

rearwardly to run over other guide pulleys 47 carried on brackets 48 extending laterally from the rear corners of the body 10. The extremities of these ropes 45 are attached to the respective rudders as can best be seen by reference to Fig. 1. Now if the handle of the lever 39 be moved to one side or the other one of the ropes 45 will be drawn upon and the other slacked off so that the rudders will be moved laterally while fore and aft movement of the lever 39 will draw upon one of the ropes 42 and relax the other so that the rudders will be moved in a forward plane. By this means the single lever controls both movements of the rudders and a combined effect of lateral and vertical steering may be readily attained.

In the operation of the device the operator starts the motor and when this is done the wing planes start to reciprocate. The reciprocation of these planes lifts the machine as previously described. If the operator wishes to ride straight in the air he manipulates the wheel 32 to move or hold the frame 14 vertical. If he wishes to go ahead he inclines the frame in a forward direction or if he wishes to go astern he inclines said frame rearwardly. In traveling either ahead or astern he adjusts the lever 39 so that the body of the machine is held substantially horizontal thus forcing the wing frames to incline to the horizontal. Lateral steering is effected in the usual manner by moving the lever 39 to one side or the other. There has thus been provided a simple and efficient device of the kind described and for the purpose specified.

It might here be stated that to positively obviate all tendency of the rods 15 to wobble, a U-shaped guide frame 49 is positioned so as to embrace each pair of the rods, one side of the frame being fixed to one of the rods as shown at 50 so that the frame moves with this rod. A pair of rollers 51 are journaled in the frame and engage opposite sides of the mating rod of the pair. Although this frame is illustrated in the drawings it may be dispensed with when unnecessary without departing from the spirit of the invention.

Having thus described the invention, what is claimed as new, is:—

1. In an ornithopter, a body, a crank shaft, spaced frames journaled on said shaft, each frame including spaced longitudinal frame members and a pair of transverse members connecting the respective ends of the longitudinal members, a plurality of spaced rollers disposed between and supported by the transverse members of the frame, a pair of reciprocatory rods slidably mounted in each frame between the transverse members and respective rollers, links respectively connecting each crank and ad-

jacent rod, and wings respectively connected to the rods above the body.

2. In an ornithopter, a body, a crank shaft, spaced frames journaled on said shaft, a pair of reciprocatory rods slidably mounted in each frame and extending above the body, links respectively connecting each crank and adjacent rod, a guide frame for the rods fixedly secured to one of said rods

above the first mentioned frame, rollers journaled in the frame to engage the opposite sides of the mating rod of the pair.

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

LEMUEL S. CUNNINGHAM.

Witnesses:

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