W. C. LAWSON.

FLYING MACHINE.

APPLICATION FILED DEC. 16, 1909.

1,008,417.

Patented Nov. 14, 1911.

4 SHEETS—SHEET 1.

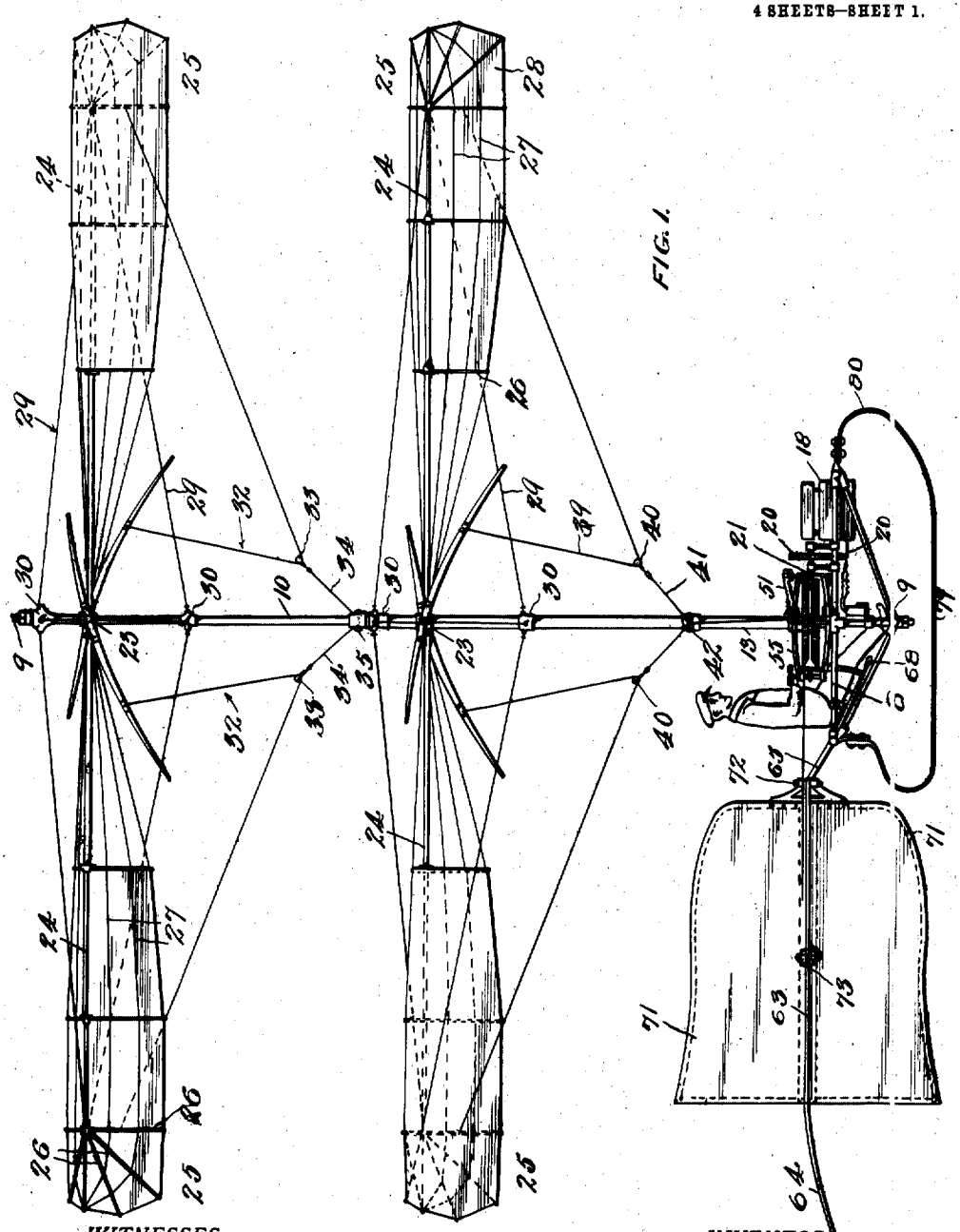

FIG. 1.

WITNESSES

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4 SHEETS—SHEET 2.

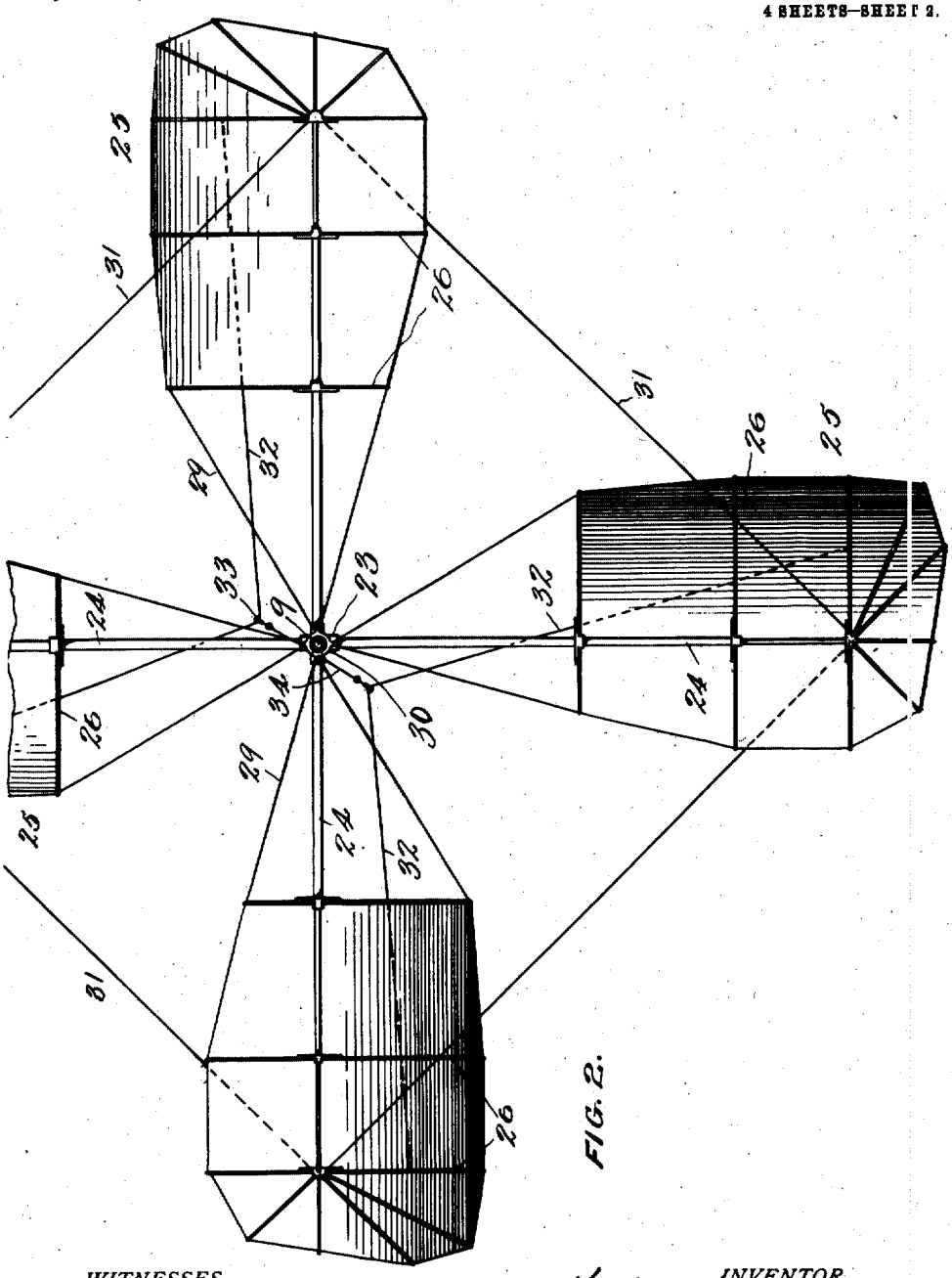

FIG. 2.

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4 SHEETS—SHEET 1.

FIG. 3.

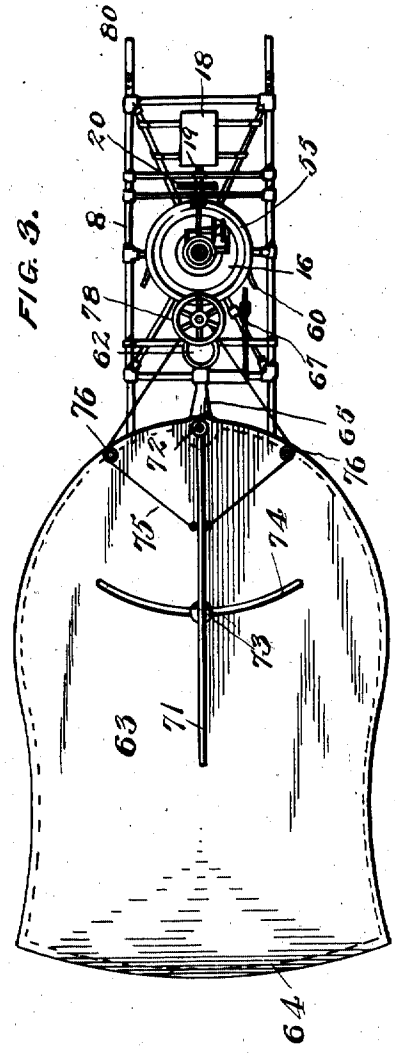
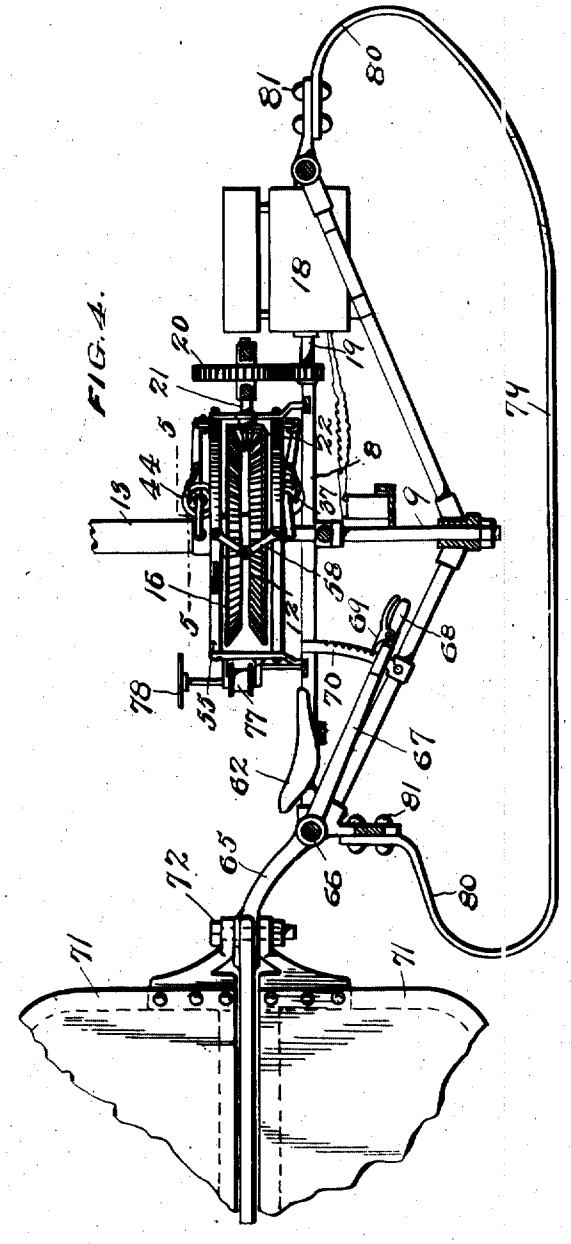


FIG. 4.



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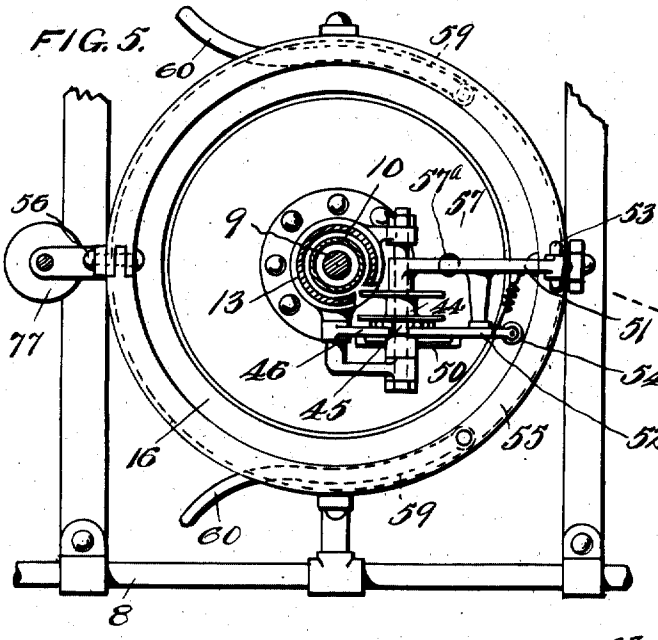
4 SHEETS—SHEET 4.

FIG. 5.



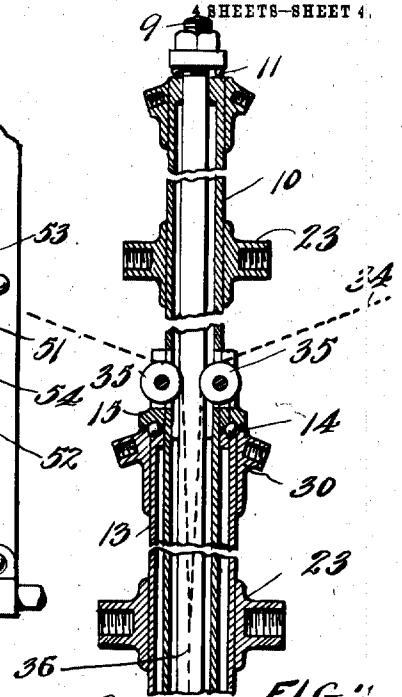


FIG. 7.

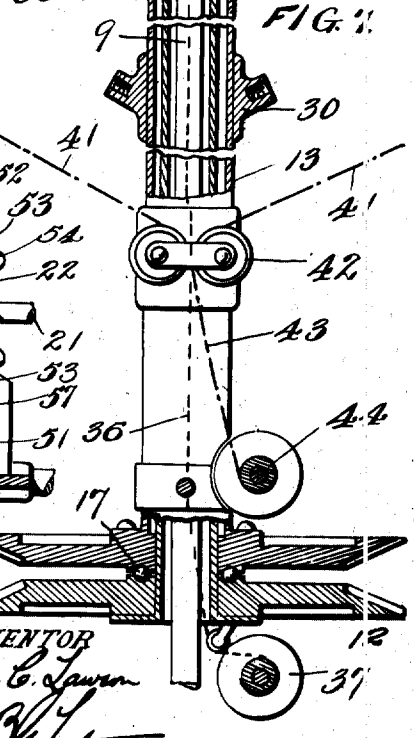
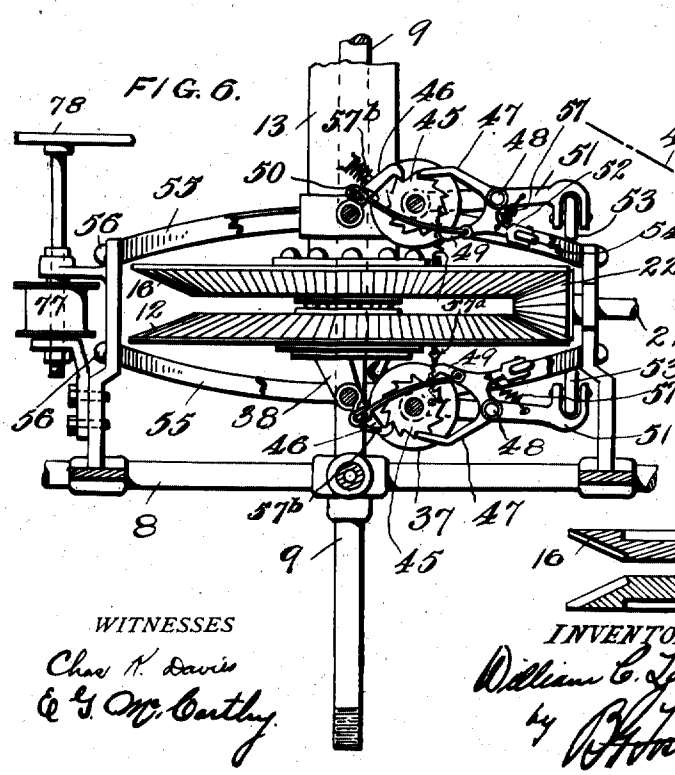


FIG. 6.



WITNESSES

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UNITED STATES PATENT OFFICE.

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FLYING-MACHINE.

1,008,417. Specification of Letters Patent. Patented Nov. 14, 1911.

Application filed December 16, 1909. Serial No. 533,376.

To all whom it may concern:

Be it known that I, WILLIAM C. LAWSON, a citizen of the United States, residing at Roanoke, in the county of Roanoke and State of Virginia, have invented new and useful Improvements in Flying-Machines, of which the following is a specification.

The present invention relates more particularly to flying machines of the helicopter type employing wheels that rotate on concentric axes and in opposite directions. One of the serious defects to this type of machine has been the difficulty of making one wheel exactly counteract the rotating effect of the other, and if there is not an exact balance, there is danger of turning the frame that carries the operator and operating mechanism. The oppositely acting influences moreover vary under different conditions. For instance, the rotating wheels always tend to throw the air outwardly, producing the effect known as "cavitation," and the amount of this cavitation varies with the speed of the wheels. The result is that the lower propeller will not have the same lifting or propelling effect as the upper wheel, because it operates, so to speak, in a partial vacuum due to cavitation, and this is increased with the speed of the wheels.

The primary object therefore of the present invention is to provide mechanism, whereby an exact counterbalancing or counteracting effect can be secured at all times, and with the greatest ease and expedition, the different wheels being individually adjusted, so that the danger of turning the machine frame is avoided, the mechanism can be placed in operation without the necessity of elevating the machine, a stationary position can be maintained when the machine has been elevated to the proper altitude, and the machine can be brought to the ground without danger whenever the operator desires, and even though the driving mechanism should become inoperative.

A further object is to provide guiding or directing means that is simple, effective and under the convenient control of the operator.

The preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation of the machine, Fig. 2 is a plan view of one of the wheels, a portion being broken away in order that the structure may be illustrated on a sufficiently large scale. Fig. 3 is a plan view of the lower portion of the structure. Fig. 4 is a side elevation of the same on an enlarged scale. Fig. 5 is a horizontal sectional view subtsantially on the line 5—5 of Fig. 4. Fig. 6 is a detail vertical sectional view through the blade-adjusting mechanism. Fig. 7 is a vertical sectional view on an enlarged scale through the shafting and associated parts.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

In the embodiment disclosed, an open frame 8 is employed, preferably constructed of light but strong tubing and suitable couplings. This frame supports a central fixed and vertical standard 9, on which is journaled an inner tubular shaft 10 having an upper thrust ball bearing 11, and carrying at its lower end a beveled gear 12. An outer tubular shaft 13 of less length than the inner shaft 10, is journaled on said tubular shaft 10, and has an upper thrust ball bearing 14 against a collar 15 fixed to the shaft 10. An oppositely disposed beveled gear 16 is fixed to the lower end of the outer shaft 13, and interposed between the two gears, is a ball bearing 17. A motor, shown conventionally at 18, is mounted in the front end of the supporting frame 8, and has a shaft 19 geared, as shown at 20, to a countershaft 21 that is provided with a beveled pinion 22 meshing with the gear wheels 12 and 16, and thereby driving the shafts 10 and 13 in opposite directions.

Each shaft is provided with a coupling 23, carrying radially disposed arms 24, on which are rotatably mounted blades or wings 25, these wings consisting of transversely disposed ribs 26 connected by stretcher cords 27 and covered by suitable fabric 28. The blades of the upper wheel are set at an opposite inclination to those of the lower wheel, and it will be observed, particularly by reference to Fig. 1 that the advance portion of each blade on one side of its shaft or arms 24 is shorter than the rear side. Moreover, in actual practice, the said advance portions are substantially straight, while the rear portions are curved. The wings or blades are braced by strut wires or cords 29, extending from brackets 30 fast to the shafts, and the outer ends of the arms of each wheel are also connected by tie rods or cables 31, shown in Fig. 2.

The adjacent pairs of blades of the upper wheel are connected by a cable 32 that passes around a pulley 33, and connected to each of the pulleys 33 is a cable 34 that in turn passes over a pair of pulleys 35 fixed to the collar 15. The cables 34 are connected to a common cable 36, as indicated in dotted lines in Fig. 7, and this common cable passes between the stem 9 and the inner shaft 10. It extends through the lower gear wheel 12, and is wrapped upon a drum 37 journaled in brackets 38 fixed to the lower wheel. This said drum is not only rotatable on its own axis, but revolves with the wheel 12 about the axis of the inner shaft 10. The pairs of adjacent wings of the lower wheel are in like manner connected by cables 39, on which are mounted pulleys 40 connected by a cable 41. This cable 41, as shown, particularly in Fig. 7, passes over pulleys 42 mounted on the exterior of the shaft 13 and is connected to another cable 43 that wraps upon a drum 44. The drum 44 is journaled in brackets on the outer shaft 13, and is therefore not only rotatable on its own axis, but revolves with said shaft. Mechanism is employed for rotating the two drums 37 and 44, and as these mechanisms are similar in all respects, being merely arranged in reverse relation, a description of one is believed to be sufficient for both.

Each drum, as illustrated in Fig. 6, carries a ratchet wheel 45, with which coöperates a pivoted holding dog 46. An actuating dog 47 is pivoted at 48 on an actuating arm 51 that has as its axis of movement the journal axis of the drum. The dog 47 also constitutes part of let-off escapement mechanism, being formed integral with a let-off dog 49. The dog 49 is connected with the holding dog 46 by a link 50 having a pin and slot connection with the latter, and formed integral with the dog 49, or else fixed with relation thereto, is a let-off actuating arm 52. The arm 51 carries a vertically disposed roller 53, and the arm 52 has an outwardly extending roller 54. A cam device coöperates with the roller 53, and comprises a circular track, formed of sections 55 suitably pivoted together upon the frame, as shown at 56, and being arranged so that the portions midway between their pivot points may be elevated into the path of movement of the roller 53 carried by the actuating arm 51. When so elevated, it will be evident that the roller 53, riding around on the track 55, will be twice elevated on each revolution of the shaft, thereby actuating the dog 47 and causing the drum to be rotated. On the other hand, when the cam tracks are depressed, the arm 51 will be revolved without being moved up and down. A spring 57 serves to always maintain the roller 53 upon its track, and other springs 57^b and 57^a maintain the other roller 54 and the dog 46 in proper operative relations. Any suitable means may be employed for swinging the said cam tracks, but in the present embodiment a pair of toggle links 58 is employed, the links being pivoted together, and to the upper and lower track sections respectively. When the links are straightened, the tracks will be moved to produce the cams. When the links are bent, as shown in Fig. 4, a straight track that has no effect on the actuating arm is obtained. In order to effect the unwinding of the drums, the arm 52 and its roller 54 are employed, and mounted on the track sections 55 are pivoted arms 59 having outstanding handles 60. These arms can be swung inwardly so as to engage the rollers 54.

Briefly described, the operation of this portion of the mechanism is as follows: Assuming that the shafts 10 and 13 are being rotated in opposite directions, if either the upper or lower cam tracks 55 are moved, by holding one stationary and moving the other the arms 51, as already explained, on each revolution, will swing upwardly and downwardly, thus causing the dogs 47 to operate on the ratchet teeth of the wheels 45, and rotate the drums. This will cause the cables 36 and 43 to be wound thereupon, which will turn the blades to any desired inclination, and when properly placed, by moving the cam tracks to their inactive positions, said blades will be retained as the drums will be held against retrograde rotation by the holding dogs 46, the movements of which are permitted by the slots in the links 50. On the other hand, if it is desired to bring the blades to or toward horizontal relations, it is only necessary to swing in the members 59, thereupon the rollers 54 will strike the said members, which acting as cams, will move the arms 52 inwardly. This will cause the disengagement of the dogs 46 and 47 from the ratchet wheels 45, but will also cause the let-off dogs 49 formed integral with the dogs 47 to move into the path of the teeth and thus permit each wheel 45 with its drum to move backwardly just the distance of one tooth.

The operator's seat is shown upon the rear end of the machine at 62, and disposed in rear thereof is the guiding or directing means. In the present embodiment, a horizontally disposed rudder 63 having a downwardly turned rear end 64 is carried by an arm 65 that is pivoted at 66 on the main frame, and has a forwardly projecting lever 67 that terminates in a handle grip 68. The lever is provided with a holding dog 69 of suitable construction that coöperates with a rack 70, said lever being so arranged that the grip is in convenient relation to an operator seated on the saddle 62, who can by manipulating said lever, raise and lower

the horizontal rudder. A vertical rudder, comprising upper and lower sections 71 that are respectively disposed above and below the horizontal rudder 63, is pivoted, as shown at 72 on said horizontal rudder, the sections being connected by a tie piece 73 extending through the curved slot 74 in the horizontal rudder. Secured to the opposite sides of the vertical rudder 71 is a cable 75 that passes about pulleys 76 on said horizontal rudder, and has its central portion wrapped a number of times about a drum 77 journaled on the main frame in advance of the operator and having an actuating handle 78. By turning this drum 77, the vertical rudder can be swung horizontally, as desired. In order to support the machine on the ground as well as to avoid all shock to the same when alighting, there are preferably employed a pair of spring steel runners 79 that have upturned terminals 80 secured to the frame, as shown at 81.

The operation of the machine is substantially as follows. Assuming that it is stationary upon the ground, the operator can locate the blades in substantially horizontal position, and start the engine without in any manner affecting the machine. Having seen that everything is in proper running order, the operator can then take his position, and by adjusting the cam tracks, bring the blades to the desired inclinations. In this connection, it is to be observed that the different wheels can be individually adjusted, for example by holding one stationary and moving the other which is an important feature, because of the different actions of the wheels under differing conditions. Having ascended to the desired height, by letting off the drums, the elevating action can be stopped while the proper counterbalancing or counteracting action of the two wheels can be maintained. To propel the machine, it is only necessary to depress the horizontal rudder, whereupon the frame and the wheels will be tilted, so that the machine will be drawn forwardly by the latter. The direction of movement can of course be governed through the medium of the vertical rudder, which can be swung in either direction by operating the drum.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

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

1. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, mechanism rotatable with the blades for effecting their adjustment to different fixed relations, and means for actuating the adjusting mechanism, said adjusting mechanism during its rotation moving into and out of engagement with the actuating means.

2. In a flying machine, the combination with oppositely rotatable wheels disposed on substantially coincident axes and having adjustable blades, of means rotatable with the wheels for adjusting the blades thereof to different fixed relations, and a device movable into and out of the path of said means for automatically effecting its movement.

3. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, means for automatically effecting an intermittent adjustment of the blades and means for maintaining said blades in different fixed relations.

4. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a drum rotatable with the member, a cable connected to the blades and wrapped on the drum, ratchet mechanism rotatable with the driving member and drum for rotating the latter on its axis, and non-rotatable means for effecting the operation of the ratchet mechanism.

5. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a drum rotatable with the member, a cable connected to the blades and wrapped on the drum, and ratchet mechanism rotatable with the driving member and drum for effecting the rotation of the latter on its axis and in opposite directions.

6. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a cable for adjusting the blades, winding means for the cable rotatable with the driving member and including an actuating device, and a cam element located in the path of the actuating device for effecting its operation.

7. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a cable for adjusting the blades, winding means for the cable rotatable with the driving member and including an actuating device, and a cam element movable into and out of the path of movement of the device for effecting its operation.

8. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a cable for adjusting the blades, a winding drum for the cable, ratchet mechanism for operating the drum including an actuating arm, and a non-rotatable cam member for operating the arm.

9. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a cable for adjusting the blades, a winding drum for the cable, ratchet mechanism for operating the drum including an actuating arm, and a non-rotatable cam member movable into and out of the path of movement of the arm for actuating said arm.

10. In a flying machine, the combination with a rotatable driving member, of blades rotatably mounted thereon, a cable for adjusting the blades, a winding drum for the cable rotatable with the driving member, a ratchet wheel carried by the drum, dog mechanism for effecting a step-by-step movement of the wheel and drum, an actuating arm for the dog mechanism, and a pivotally mounted non-rotatable cam movable into and out of the path of movement of the actuating arm.

11. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a cable for adjusting the blades, a winding drum for the cable, means for rotating the drum to wind the cable thereon, means for permitting the opposite rotation of the drum to unwind the cable, and non-rotatable mechanism for effecting the operation of the means that effects the unwinding of the cable.

12. In a flying machine, the combination with a rotatable driving member, of adjustable blades mounted thereon, a cable for adjusting the blades, a winding drum for the cable, means for rotating the drum to wind the cable thereon, including a ratchet wheel on each drum, escapement mechanism for permitting the opposite rotation of the drum to unwind the cable, an actuating arm for the escapement mechanism, and a cam device movable into and out of the path of movement of the arm.

13. In a flying machine, the combination with a driving shaft, of adjustable blades rotatably mounted thereon, a cable connected to the blades, a drum carried by the shaft and having the cable wrapped thereon, a ratchet wheel for the drum, a dog and escapement means operating on the ratchet wheel, actuating arms for the dog and escapement means, and cam elements movable respectively into and out of the path of movement of the arms for effecting their operation.

14. In a flying machine, the combination with a frame having a fixed upright standard, of concentric oppositely rotatable tubular shafts journaled on the standard, bevel gears carried by the lower ends of the shafts, a motor geared to both bevel gears, adjustable blades rotatably mounted on the two shafts, cables connected to the blades for adjusting the same, drums journaled on the shafts and rotatable therewith, ratchet wheels carried by the drums, winding and unwinding mechanism for the drums including dog and escapement mechanisms having outstanding actuating arms, and cams pivoted on the frame and movable into and out of the paths of movement of the arms.

15. In a flying machine, the combination with oppositely rotatable driving members operating on substantially coincident axes, of adjustable blades mounted on the driving members, automatic means for adjusting the blades, means for maintaining said blades in permanently adjusted relations and manually controlled devices movable into and out of engagement with the automatic adjusting means for effecting the automatic operation of the same.

16. In a flying machine, the combination with oppositely rotatable concentric shafts, of adjustable blades mounted on the shafts, automatic operating devices carried respectively by the shafts for adjusting the blades mounted thereon to different permanent positions, and manually controlled devices movable into and out of engagement with the automatic operating devices for effecting their automatic operation by the rotation of the shafts.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILLIAM C. LAWSON.

Witnesses:
C. W. BISHOP,
H. B. BROCKENHUGH.