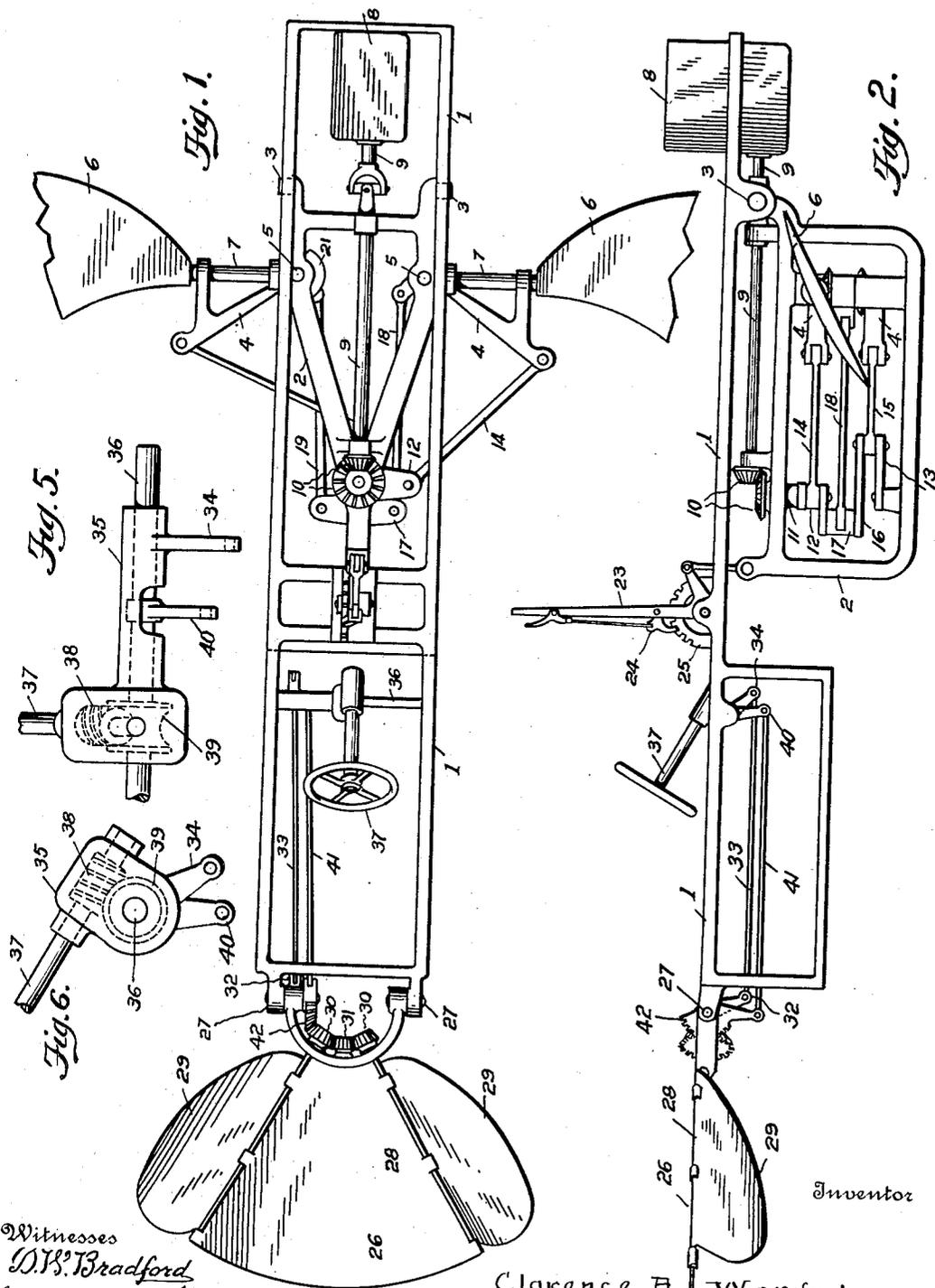


C. A. WORFEL.
 FLYING MACHINE.
 APPLICATION FILED MAY 25, 1914.

1,133,451.

Patented Mar. 30, 1915.
 2 SHEETS—SHEET 1.



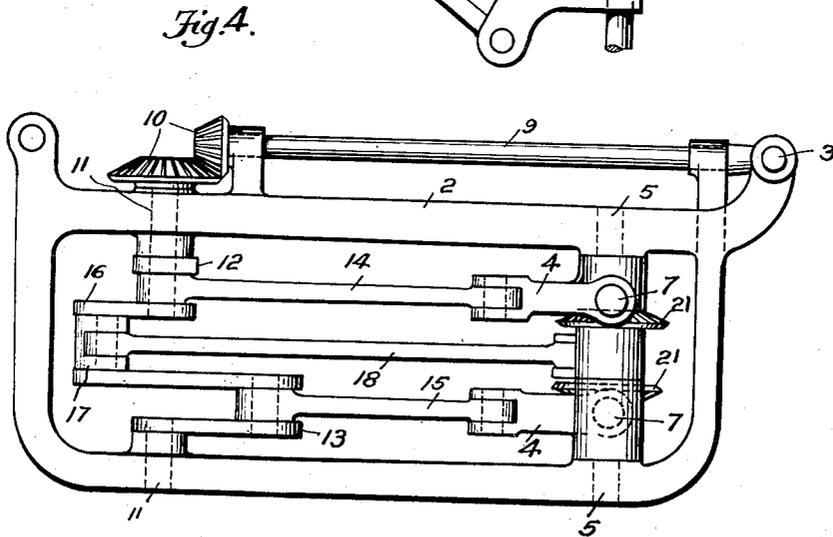
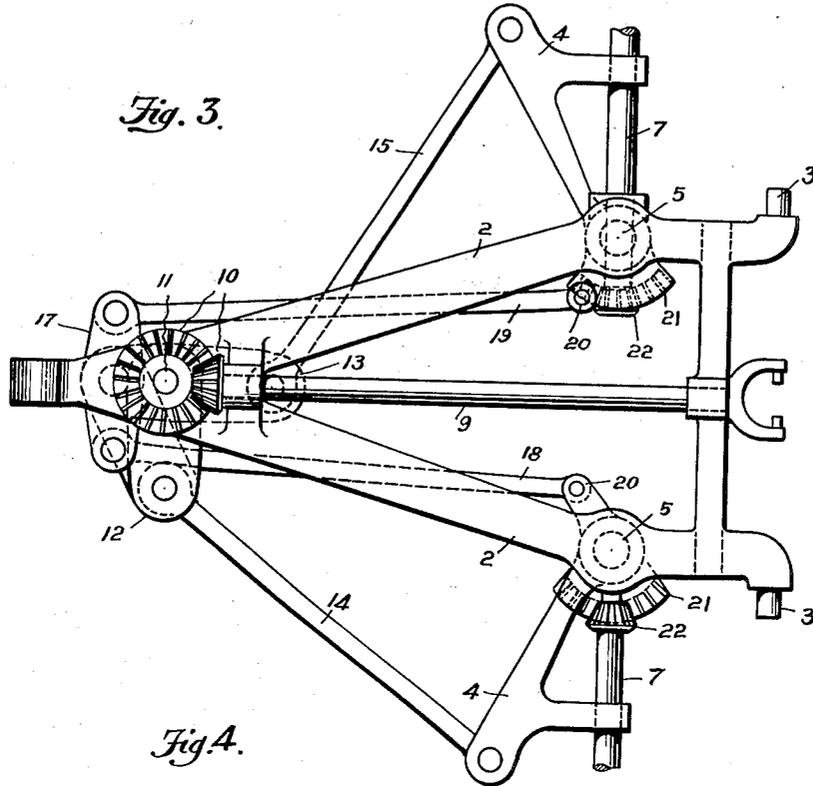
Inventor

Witnesses
 D. S. Bradford
 Marion A. Thompson

Clarence A. Worfel
 by
 Cyrus W. Rice
 his Attorney

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 2 SHEETS—SHEET 2.



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By *Cyrus W. Rice*
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UNITED STATES PATENT OFFICE.

CLARENCE A. WORFEL, OF GRAND RAPIDS, MICHIGAN.

FLYING-MACHINE.

1,132,451.

Specification of Letters Patent. Patented Mar. 30, 1915.

Application filed May 25, 1914. Serial No. 240,876.

To all whom it may concern:

Be it known that I, CLARENCE A. WORFEL, a citizen of the United States, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented new and useful Improvements in Flying-Machines, of which the following is a specification.

My present invention relates to flying machines, and its object is to provide such a machine which shall be furnished with swinging propelling wings having a limited rotary movement near, or approximately at, the ends of their swinging movement; and further, to provide such a machine which shall have improved means for effecting such movements; and further, to provide such a machine which shall have improved means for governing its course in a vertical direction; and further, to provide such a machine which shall have improved means for governing its course in a lateral direction; and further, to provide such a machine which shall be improved in various particulars hereinafter appearing.

These objects are attained by, and my invention finds a preferable embodiment in, the structure hereinafter described and illustrated in the accompanying drawings, in which:—

Figure 1 is a plan view of my flying machine, portions of the wings being broken away; Fig. 2 is a right-hand side view thereof; Fig. 3 is an enlarged plan view of the secondary frame carrying the wings, etc.; Fig. 4 is a right-hand side view of the same; Fig. 5 is an enlarged front view of parts of the steering means; and Fig. 6 is a right-hand side view of the same.

The frame 1 carries a secondary frame 2 in axially-horizontal transverse pivotal relation thereto, it being supported by the pivot 3. A pair of wing-carriers 4, having a swinging movement on axially vertical pivot pins 5 on the secondary frame, carry the propelling wings 6 which have a limited rotary or turning movement on their rockshafts 7 extending in the longitudinal direction of the wings, such shafts being journaled on the carriers. The swinging of the wings and their limited turning near the ends of their swinging movement is effected, in the construction shown, by the following mechanism:

A suitable engine (indicated at 8) rotates, through the flexible shaft 9 and gears 10, a driving shaft 11 journaled on the second-

ary frame. This shaft's cranks 12 and 13, through their connecting rods 14 and 15, swing forward and backward the right-hand and left-hand wing-carriers respectively. The driving shaft's third crank 16 carries a yoke 17 pivoted to the connecting rods 18, 19, which being pivoted at 20 to toothed segments 21, rock the same on their pivots 5, whereby (their teeth meshing with the gear 22 on the shafts 7 of the wings respectively), they impart to such wings the limited rotary or turning movement referred to. The parts are so correlated as to thus turn the wings on their shafts when they are near (approximately at) one end of their swinging movement, and to turn them in the reverse direction when near (approximately at) the other end of such movement, and the wings are so inclined during such swinging as to propel the machine and also to sustain it or cause it to rise. In order to govern the course vertically, the secondary frame may be swung on its pivot 3 by means of the lever 23, held in adjusted position as by its dog 24 and toothed segment 25.

To govern the machine's course in a lateral and also in a vertical direction, I provide a steering mechanism comprising a rudder 26 carried by the frame on a horizontal transverse pivot 27; on the rearwardly-diverging edges of the central blade 28 of this rudder are pivotally supported side blades 29 adapted, as by their gears 30 and intermeshing idler gear 31, to be simultaneously turned in opposite directions. The rudder may be turned vertically on its pivot 27 through its crank arm 32 and connecting rod 33 pivoted to a crank arm 34 of the sleeve 35 which may be rocked on its pivotal support 36, as by the handle 37; and the side blades 29 may be turned by rotating the handle 37 whose worm 38 turns a worm wheel 39 rotatable on said support 36 and having a crank handle 40 to which is pivoted a connecting rod 41 pivoted to a rotatable toothed segment 42 meshing with one of the gears 30 of the side blades. It will be seen that the turning movement of the yoke 17 on the crank pin of the crank 16 provides a "differential" connection between the wings, whereby an inequality of stress is divided between the wings.

Not confining myself to details of construction shown or described, I claim:—

1. In a machine of the character described, a frame, a pair of wing-carriers

having a swinging movement forward and backward in the same path, a wing on each carrier having a limited turning movement on an axis extending in the wing's longitudinal direction, and means for turning each wing in one portion of its support's swinging movement.

2. In a machine of the character described, a frame, a pair of wing-carriers having a swinging movement forward and backward in the same path, a wing on each carrier having a limited turning movement on an axis extending in the wing's longitudinal direction, and means for turning each wing in one portion of its support's swinging movement, and operable in connection with the swinging of the carrier.

3. In a machine of the character described, a frame, a pair of wing-carriers having a swinging movement forward and backward in the same path, a wing on each carrier having a limited turning movement on an axis extending in the wing's longitudinal direction, and means for turning each wing in one portion of its carrier's swinging movement and in the reverse direction in another portion of such swinging movement.

4. In a machine of the character described, a frame, a pair of wing-carriers having a swinging movement forward and backward in the same path, a wing on each carrier having a limited turning movement on an axis extending in the wing's longitudinal direction, and means for turning each wing in one portion of its carrier's swinging movement and in the reverse direction in another portion of such swinging movement, and operable in connection with the swinging of the carrier.

5. In a machine of the character described, a frame, a pair of wing-carriers having a swinging movement, a wing on each carrier having a limited turning movement on an axis extending in the wing's longitudinal direction, a driven shaft, and connecting rods actuated by the rotation of the shaft and some of which are adapted to swing the carriers, and others to turn the wings.

6. In a machine of the character described, a frame, a secondary frame in pivotal adjustable relation to the frame on a transverse axis, a pair of wing-carriers having a swinging movement, a wing on each carrier and having a limited turning movement on an axis extending in the wing's longitudinal direction, a driven shaft, and connecting rods actuated by the rotation of the shaft and some of which are adapted to swing the carriers, and others to turn the wings.

7. In a machine of the character described, a frame, a pair of wing-carriers having a swinging movement, a wing on

each carrier and having a limited turning movement on an axis extending in the wing's longitudinal direction, means for turning each wing in one portion of its support's swinging movement and in the reverse direction in another portion of such swinging movement, comprising a yoke centrally pivoted on the driving mechanism of the machine, gears carried by the wings, segments meshing with the gears, and connecting rods pivoted to the respective segments and to the yoke on opposite sides of its said central pivot.

8. In a machine of the character described, a frame, a pair of wing-carriers having a swinging movement, a wing on each carrier and having a limited turning movement on an axis extending in the wing's longitudinal direction, segments having a limited turning movement in engagement with the wings and adapted to turn the same, a driven shaft having a crank, connecting rods actuated by the rotation of the shaft and adapted to swing the carriers, a yoke pivoted on the crank, and connecting rods pivoted on the yoke on opposite sides of its pivotal connection with the crank, said last mentioned rods being pivoted on the segments respectively and adapted to turn the same.

9. In a machine of the character described, a frame, a secondary frame in pivotal adjustable relation to the frame on a transverse axis, a pair of wing carriers having a swinging movement on the secondary frame, a wing on each carrier and having a limited turning movement on an axis extending in the wing's longitudinal direction, means for turning each wing in one portion of its support's swinging movement, and a steering mechanism comprising a rudder carried by the frame.

10. In a machine of the character described, a frame, a secondary frame in pivotal adjustable relation to the frame on a transverse axis, a pair of wing carriers having a swinging movement on the secondary frame, a wing on each carrier and having a limited turning movement on an axis extending in the wing's longitudinal direction, means for turning each wing in one portion of its support's swinging movement, and operable in connection with the swinging of the carrier, and a steering mechanism comprising a rudder carried by the frame.

11. In a machine of the character described, a frame, a secondary frame in pivotal adjustable relation to the frame on a transverse axis, a pair of wing carriers having a swinging movement on the secondary frame, a wing on each carrier and having a limited turning movement on an axis extending in the wing's longitudinal direction, means for turning each wing in one portion of its carrier's swinging movement

and in the reverse direction in another portion of such swinging movement, and a steering mechanism comprising a rudder carried by the frame.

portion of its carrier's swinging movement and in the reverse direction in another portion of such swinging movement, and operable in connection with the swinging of the carrier, and a steering mechanism comprising a rudder carried by the frame. 15

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses. 20

CLARENCE A. WORFEL.

Witnesses:

ELBERT F. LEWIS,
H. DALE SOUTER.

5 12. In a machine of the character described, a frame, a secondary frame in pivotal adjustable relation to the frame on a transverse axis, a pair of wing carriers having a swinging movement on the secondary
10 frame, a wing on each carrier and having a limited turning movement on an axis extending in the wing's longitudinal direction, means for turning each wing in one