S. H. FRENCH.

FLYING MACHINE.

APPLICATION FILED AUG. 4, 1909.

976,161.

Patented Nov. 22, 1910.

2 SHEETS—SHEET 1.

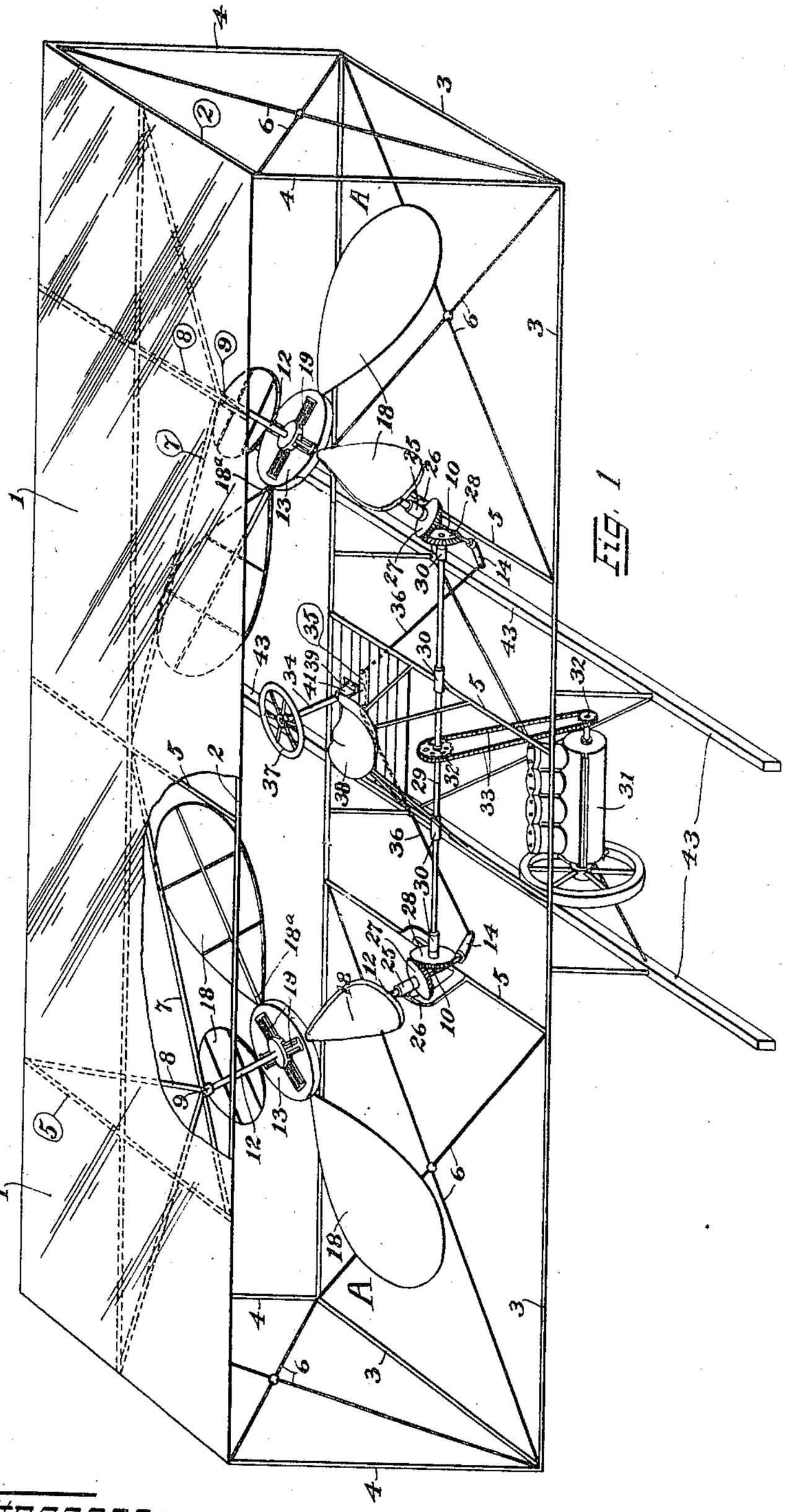

FIG. 1

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his attorney.

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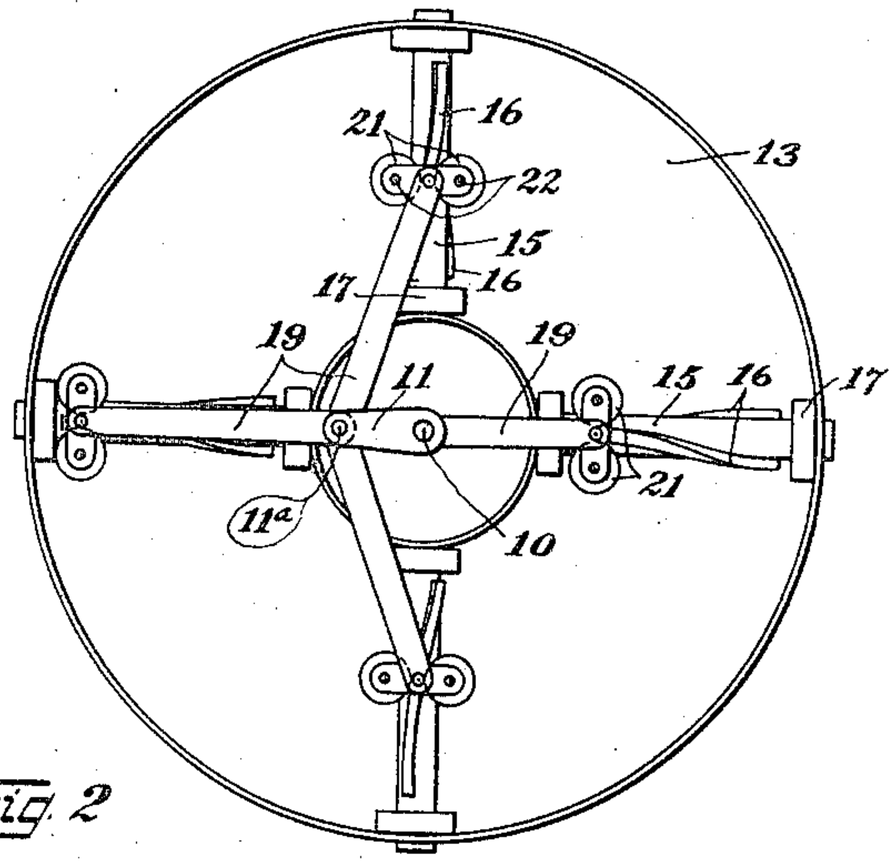

Fig. 2

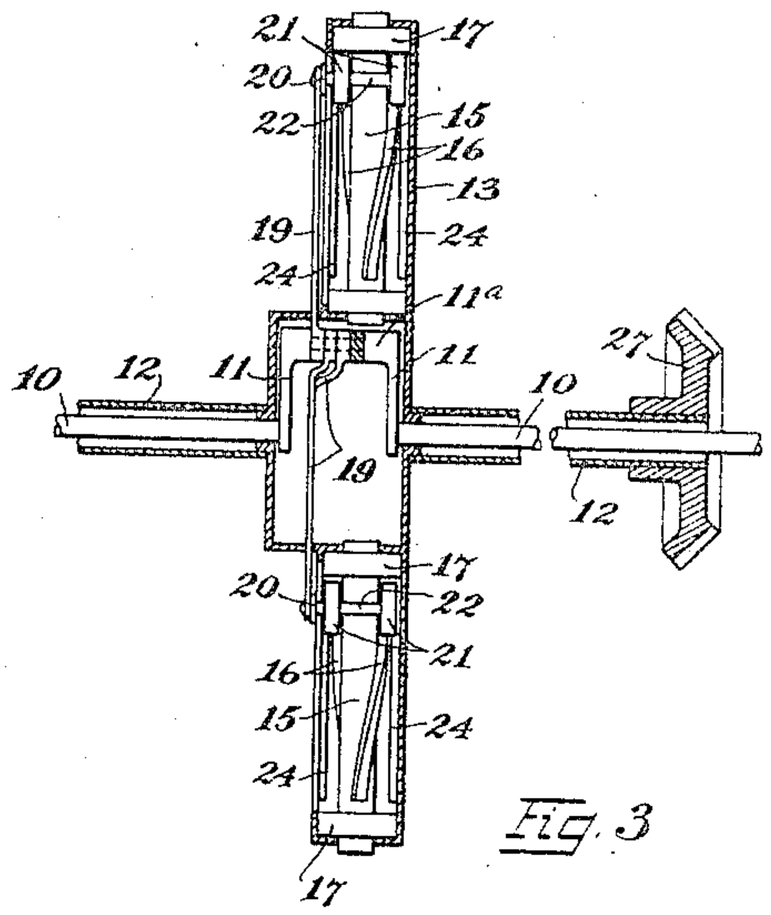

Fig. 3

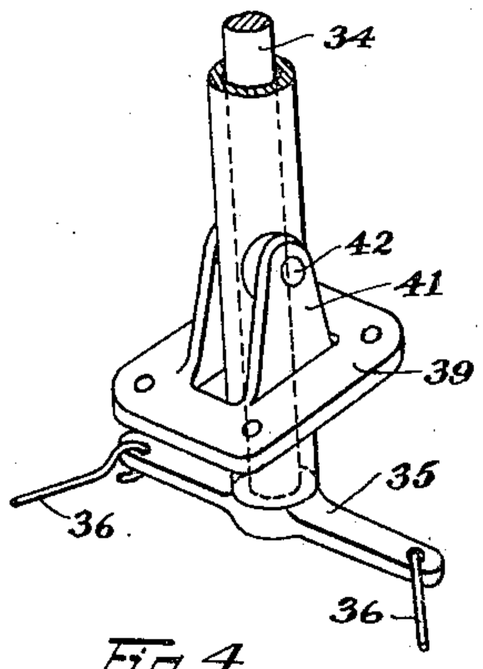

Fig. 4

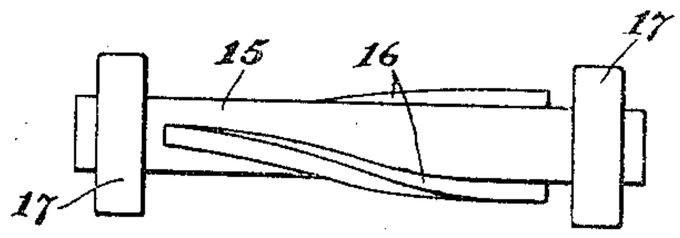

Fig. 5

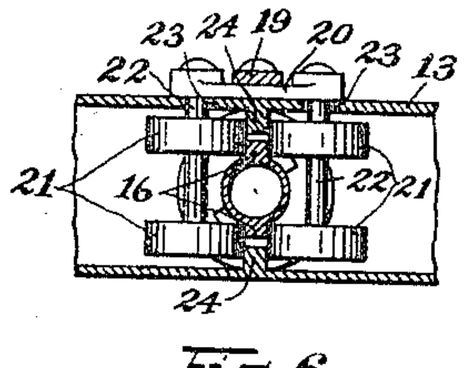

Fig. 6

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UNITED STATES PATENT OFFICE.

SILAS H. FRENCH, OF OBERLIN, OHIO.

FLYING-MACHINE.

976,161. Specification of Letters Patent. Patented Nov. 22, 1910.

Application filed August 4, 1909. Serial No. 511,085.

To all whom it may concern:

Be it known that I, SILAS H. FRENCH, a citizen of the United States, residing at Oberlin, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Flying-Machines, of which the following is a specification.

My invention relates to improvements in flying machines of the aeroplane type in which the weight is sustained by the reaction resulting when one or more aeroplanes are moved through the air edgewise at a small angle of incidence by the application of mechanical power through the medium of a screw propeller.

The invention relates more particularly to aerial propellers, the object of the improved propeller herein shown and described being to provide an improved propeller adapted to coöperate with one or more aeroplanes so as to combine some of the principles and advantages of both the aeroplane and the helicopter, and at the same time, providing means for controlling the direction of flight and maintaining or restoring equilibrium by means of the feathering propeller blades provided with mechanism for regulating the feathering of said propeller blades whereby their point of most effective sweep and angle of incidence may be shifted to meet the exigencies of flight.

The propellers now in common use in connection with flying machines of the aeroplane type do not differ essentially in their construction or mode of operation from the ordinary marine propeller and as their blades are stationary and no means are provided whereby the point of most effective sweep and angle of incidence may be shifted to meet the exigencies of flight, the direction of flight and the maintaining or restoring of equilibrium or lateral balance are dependent upon helicoidal warping or other movements of the aeroplanes in connection with vertical and horizontal rudders, or by means of rudders alone of various forms and types.

The primary object of this invention is to provide a generally improved aerial propeller provided with feathering blades under direct control of the operator at all times, and adapted to coöperate with the aeroplanes for the purposes above mentioned and adapted to exert much greater power or forward thrust for the power applied than is now attained by the ordinary propeller.

With the above mentioned ends in view, the invention consists in the novel construction, arrangement, and combination of parts, hereinafter described, illustrated in one of its embodiments in the accompanying drawings, and particularly pointed out in the appended claims.

Referring to the drawings, forming a part of this specification, Figure 1, is a perspective view of a flying machine of the aeroplane type constructed in accordance with my invention. Fig. 2, an enlarged detail plan view of one of the improved propeller hubs, one of its walls being removed for the purpose of showing the mechanism for feathering the propeller blades. Fig. 3, a central cross sectional view of the same showing arrangement of the axle shaft for regulating the feathering of the blades and the tubular driving shaft for imparting motion to the improved propeller. Fig. 4, an enlarged detail perspective view of the lower portion of the steering shaft or column with its mountings and connections. Fig. 5, a detail plan view of one of the oscillating spindle shafts carried by the hub portion of the improved propeller for carrying and feathering the propeller blades. Fig. 6, a cross sectional view of the same as it appears in the hub casing in connection with the adjacent operating mechanism.

Similar numerals of reference designate like parts throughout all the figures of the drawings.

In the present embodiment of the invention I have shown the improved feathering blade propellers in connection with aeroplane or flying machine of the monoplane type, though it is obvious that these propellers are adapted for application to aeroplanes of various forms and types. The aeroplane or monoplane 1, may be formed by stretching cloth or other suitable fabric over a rectangular frame 2, in any suitable and convenient manner, said frame, in the present instance, being carried upon a subjacent supporting frame of suitable form which may consist of a second rectangular plane 3, provided at its corners with upright standards or bars 4, suitably connected to the corners of the rectangular frame 2. A number of cross bars 5, may be carried by the frames 2 and 3, and the front and rear edges of said rectangular frames may be provided with additional upright bars and strengthened in any suitable and convenient

manner. The entire superstructure may be suitably strengthened or trussed by means of diagonally disposed brace or stay wires 6.

In the present embodiment of the invention the rectangular frame 2, is further strengthened by means of longitudinally extending brace bars 7, intersected intermediate their ends by means of cross brace bars 8, said bars 7, and 8, depending downwardly and provided at their intersecting portions with bearing heads 9, for the upper ends of the propeller shafts hereinafter described.

Each propeller comprises an axle shaft 10, provided with a crank arm 11, and a tubular or sleeve driving shaft 12, said tubular shaft surrounding the axle shaft 10, and carrying a hub portion 13, in the present instance, in the form of a hub casing surrounding the crank arm 11. Each axle shaft 10, is adapted to be oscillated for the purpose of regulating the feathering of the blades as hereinafter described by being provided at the lower end with an operating crank arm 14, connected to suitable mechanism hereinafter described.

The hub portion or casing 13, carries a plurality of spindle shafts 15, provided with longitudinally-extending spiral ribs 16. The spindle shafts 15, are adapted to be oscillated by the mechanism hereinafter described and are carried at their ends in bearing blocks 17, said bearing blocks being preferably provided with ball or roller bearings (not shown) for the purpose of reducing the friction to a minimum. The propeller blades 18, may be formed in any suitable and convenient manner, preferably of the form shown, and, in the present instance, provided with shank or spindle portions 18^a, adapted to be secured in the ends of the spindle shafts 15. It is evident, however, that the shank or spindle portions 18^a, of the propeller blades might be formed integral with the spindle shafts 15.

As a means for feathering the propeller blades 18, at proper points in their paths of revolution a plurality of connecting arms or links 19, are provided, said links being connected at their inner ends to the cross arm portion 11^a, of the double crank arm 11, of the axle shaft 10, and provided at their outer ends with cross heads 20, carrying guide rollers 21. The guide rollers 21, are mounted upon axle pins or bars 22, extending through slots 23, of the hub casing 13, said guide rollers 21, being adapted to travel in their reciprocating motion upon guide members 24, of hub casing 13. It will be observed that the guide rollers 21, are arranged on each side and take over the spiral ribs 16, so that as the guide rollers 21, are reciprocated during the revolution of the propeller said guide rollers will oscillate the spindle shafts 15, and thus feather the propeller blades 18, at the points desired as hereinafter described.

Each propeller driving shaft 12, is mounted, in the present instance, at its end in the bearing head 9, formed at the intersection of the brace bars 7, and 8, and is carried at its lower end in a bearing head 25, of a bearing arm 26, of one of the cross bars 5. It will thus be observed that the propeller driving shafts extend upwardly and diverge from each other beneath the aeroplane 1, so that the propellers are adapted to revolve in outwardly diverging planes beneath said aeroplane. As a means for revolving said driving shafts, each shaft is provided at its lower end with a bevel gear 27, meshing with an adjacent bevel gear 28, carried upon the ends of a horizontally-disposed driving shaft 29, mounted in suitable bearings 30. In the present instance said driving shaft 29, receives its motion from a motor 31, through the medium of the sprocket wheels 32, and a sprocket chain 33.

The propellers are adapted to be revolved in opposite directions and away from each other in downwardly diverging planes beneath the aeroplane and are adapted to have their feathering blades present their most effective sweep at their outer or lateral paths of revolution A, as indicated in Fig. 1, of the drawings, whereby the same is carried forwardly, and as a means for preventing the blades from retarding such movement in the further revolution of the blades, and, more particularly, for imparting an upward or helicopter action to the propeller, the propeller blades are presented at an angle from said point of most effective sweep and during the rear path of their revolution as indicated in said Fig. 1, of the drawings. During the remaining portion of the path of revolution of said propeller blades and to a point slightly beyond and below the plane of travel of the aeroplane passing through or intersecting the axis of said propeller the propeller blades are feathered edgewise so as to offer little or no resistance to the air in the forward movements of the aeroplane. As a means for regulating the feathering of said propeller blades whereby the point of most effective sweep and angle of incidence above described may be shifted to meet the exigencies of flight for the purposes hereinbefore referred to a steering shaft or column 34, is mounted near the front edge of the second rectangular frame 3, and is provided at its lower end with a cross head 35, carrying connecting rods or links 36, extending outwardly and rearwardly and connected to the operating cranks 14, whereby the axle shafts 10 may be shifted or oscillated to regulate the feathering of the propeller blades in an obvious manner in view of the construction hereinbefore described. The steering shaft 34, is provided at its top with

a steering wheel 37, so as to be within ready reach of the operator seated upon the seat 38, and as a means for imparting simultaneous and like movements to the axle shafts 10, the steering shaft 34, is adapted to be rocked to and fro by being pivotally mounted at its lower end in a bearing plate 39, provided with a slot 40, and upwardly extending bearing lugs 41, carrying a transversely disposed bearing pin 42. The truss-skids 43, carried by and extending forwardly beneath the second rectangular frame 3, extend forwardly and carry upon their front ends a front horizontal rudder of any suitable and convenient construction.

From the foregoing description, taken in connection with the accompanying drawings, the operation and advantages of my invention will be readily understood.

Having thus described an embodiment of my invention, what I claim and desire to secure by Letters Patent is,—

1. A flying machine, comprising a frame carrying an aeroplane, a pair of propellers provided with feathering blades, means for driving said propellers in opposite directions, and means for simultaneously varying the feathering of said feathering blades whereby to maintain lateral balance.

2. A flying machine, comprising an aeroplane, propellers revolving in opposite directions in outwardly diverging planes and provided with feathering blades, and means for feathering said blades at such points in the revolution of said propellers as will tend to maintain or restore lateral balance.

3. A flying machine, comprising an aeroplane, a propeller on each side thereof, each of said propellers revolving in opposite directions and provided with feathering blades presenting their point of most effective sweep at the outer sides of their paths of revolution, and means for simultaneously varying the point of most effective sweep of said feathering blades at each side of said aeroplane whereby to meet the exigencies of flight.

4. A flying machine, comprising an aeroplane, propellers disposed beneath said aeroplane and provided with axially movable propeller-blades, means for revolving said propellers, means for axially oscillating said propeller blades during the outer and rearward paths of the revolution of said propellers, and means for varying the point of most effective sweep of said propellers whereby to maintain lateral balance and control the direction of flight.

5. In a flying machine, an aeroplane, a supporting frame therefor, propellers carrying feathering blades presenting their point of most effective sweep at their lateral paths of revolution and during a portion of their revolution presented at an angle from said point of most effective sweep whereby said aeroplane is carried forwardly and upwardly and means for simultaneously varying the point of most effective sweep and angle of incidence of said feathering blades at like and unlike portions of their paths of revolution.

6. A flying machine, comprising an aeroplane, propellers revolving in outwardly diverging planes beneath said aeroplane and provided with feathering blades presenting their point of most effective sweep at their outer paths of revolution, and means for controlling and regulating the feathering of said blades whereby to control the direction of flight and maintain equilibrium.

7. A flying machine, comprising a frame carrying an aeroplane, a pair of upwardly extending and diverging propeller shafts disposed beneath said aeroplane, propellers revolving in outwardly diverging planes beneath said aeroplane and provided with feathering blades presenting their point of most effective sweep at the outer paths thereof, and means for controlling and feathering said blades.

8. In a flying machine, the combination with an aeroplane and a supporting frame therefor; of propellers revolving in outwardly diverging planes beneath said aeroplane and carrying feathering blades presenting their point of most effective sweep at their outer lower paths of revolution and presented at an angle from said point through their rear paths whereby said aeroplane is carried forwardly and upwardly, and means for regulating the feathering of said blades whereby said point of most effective sweep and angle of incidence may be shifted to meet the exigencies of flight.

9. A flying machine, comprising an aeroplane and a supporting frame therefor, a propeller axle shaft provided with a crank at each side of said supporting frame, a tubular driving shaft surrounding each of said axle-shafts and provided with a hub, spindle shafts carried by each of said hubs and each provided with longitudinal spiral ribs, link-arms carried by the crank of each of said axle shafts and provided at their ends with guide-rollers taking over said spiral ribs of said spindle shafts, propeller blades carried by said spindle shafts, operating crank arms at the lower ends of said propeller axle shafts, a steering column provided with a cross head, and connecting rods connecting said cross head with said operating crank arms whereby said propeller axle shafts may be oscillated to regulate the feathering of said propeller blades.

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

SILAS H. FRENCH.

Witnesses:

LOUIS E. BURGNER,

F. E. GEILLS.