G. E. MOIR.

FLYING MACHINE.

APPLICATION FILED JUNE 26, 1920.

1,403,909. Patented Jan. 17, 1922.

2 SHEETS—SHEET 1.

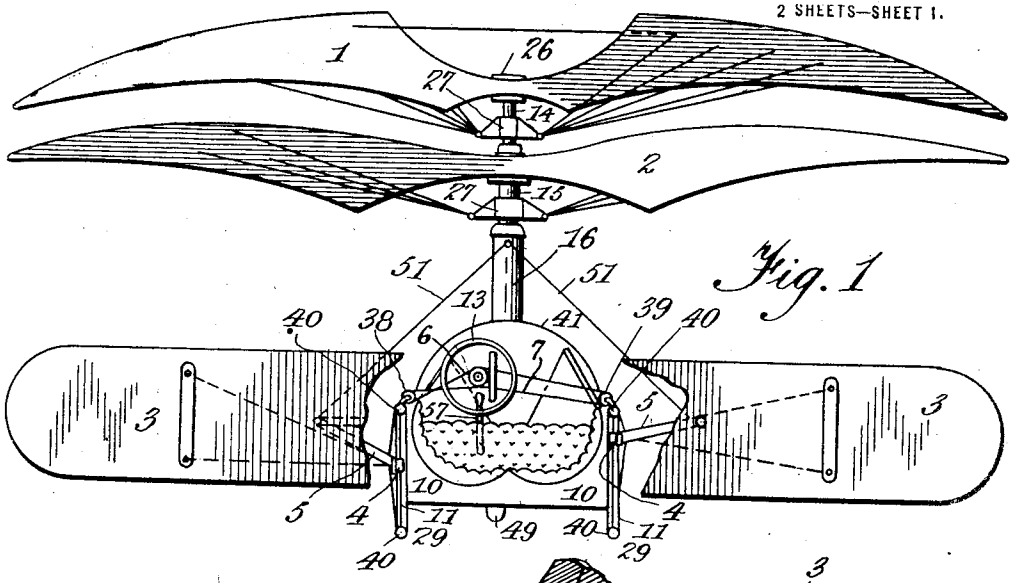


Fig. 1

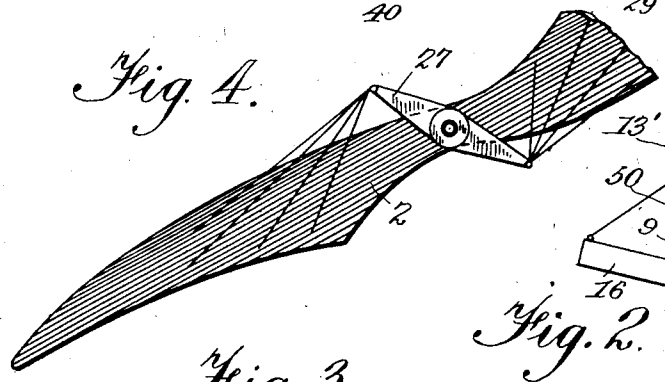


Fig. 4.

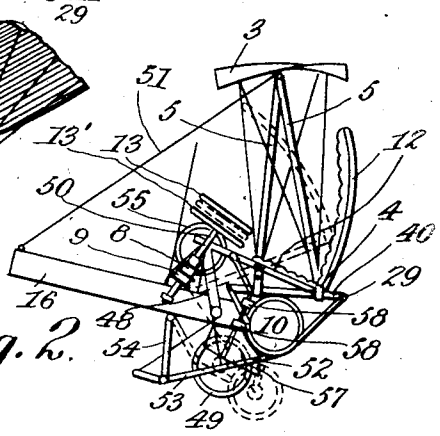


Fig. 2.

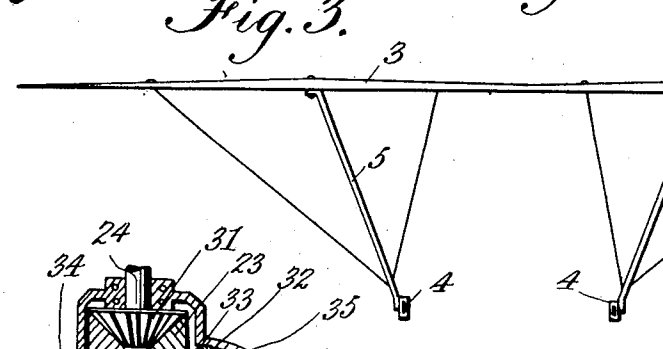


Fig. 3.

Fig. 5

Fig. 6.

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2 SHEETS—SHEET 2.

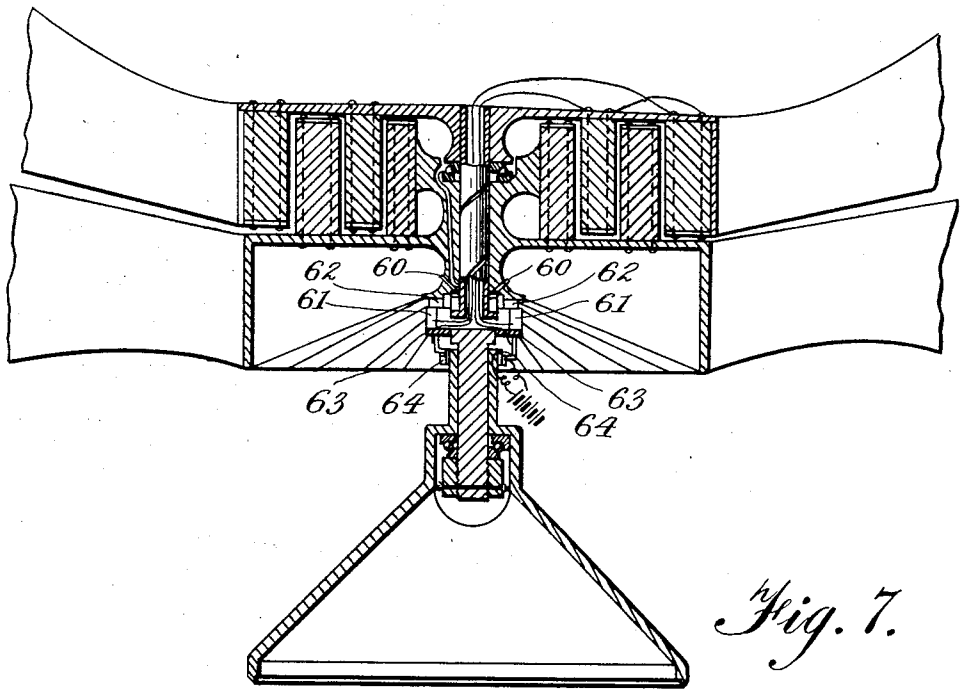


Fig. 7.

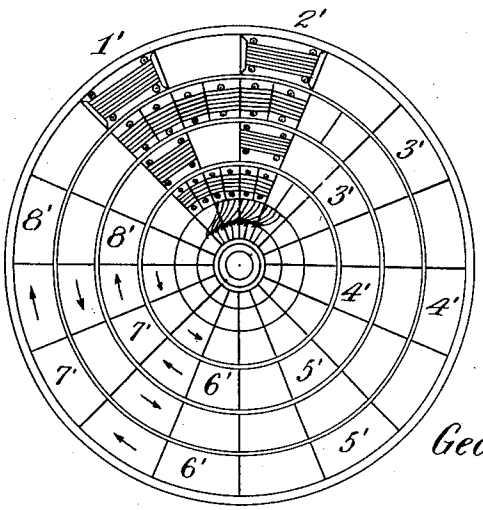


Fig. 8.

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UNITED STATES PATENT OFFICE.

GEORGE EVENLY MOIR, OF CAMPBELLTON, NEW BRUNSWICK, CANADA.

FLYING MACHINE.

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Application filed June 26, 1920. Serial No. 392,012.

To all whom it may concern:

Be it known that I, GEORGE E. MOIR, a subject of the King of Great Britain, residing at Campbellton, Province of New Brunswick, Canada, have invented certain new and useful Improvements in Flying Machines; and I do hereby declare that the following is 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.

The present invention relates to flying machines, and has for its particular object to provide a flying machine that will rise vertically, fly horizontally or obliquely, land on uneven ground or remain stationary in mid-air, and, of which the vertical descent may be effected and controlled with equal facility.

Another object of this invention is to provide an air-craft, capable of vertical ascent, descent and hovering in flight, which may be operated either by gasoline or electric motors.

A further object of the invention is to provide a flying machine whose wind-thrust is equal at any radius of its propeller, which may be steered by a steering plane of a breadth sufficient to engage the wind-thrust clear across its current, which is adjustable in pitch at either end to cause veering, and at both ends to cause the wind-thrust to lift the rear of said machine to a nearly horizontal position for a direct voyage course.

A still further object of the invention is to provide a flying machine in which the driving shafts, revolving one within the other, are automatically lubricated, at all their bearings by their own motion, which governs the flow of oil relatively to their speed, and, the same oil adapted to be received over and over again into an oil chamber for circulation.

Another object of the same invention is to provide a flying machine having a single steering element, whose plurality of members are manipulated from one center for all purposes, and, are so designed, constructed and arranged as to automatically guide the machine gently in its downward motion in case of faint, collapse or failure of the pilot.

Another object of the invention is to provide an air-craft, capable of vertical flight, having varying pitch of propeller blades.

With the above and other objects in view which may appear as the description continues or which may otherwise be inherently related with the scope and nature of this invention, the latter consists in details of construction and in arrangement of combination of parts as illustrated in the hereunto annexed drawings, with which the present specification is collaterally related.

Reference is now to be had to the said accompanying drawings, wherein like characters of reference denoting corresponding parts in the several views thereof, are designated for identification purposes by similar reference characters throughout this description.

Figure 1 shows a top or plan view of the flying machine, with the steering plane partially broken at its center so as to disclose the steering element and its plurality of members. This view further shows substantially the position that said flying machine assumes in its vertical ascension;

Figure 2 is a side elevation of the machine, showing same in a nearly horizontal position;

Figure 3 is an elevation of the steering plane;

Figure 4 illustrates a propeller blade;

Figure 5 is a sectional view on line *a*—*a* of Figure 2, showing the gears for connection with the motors and the spiral grooving for automatic lubrication purposes;

Figure 6 is an enlarged partial view of Figure 5, showing oil cups and tube connections;

Figure 7 is a view of the motor, showing its connection with the propeller blades and its winding construction, and,

Figure 8 is a plan view, partly schematic, showing the arrangement of the oppositely rotatable solenoids which are secured to the propeller hubs and function as a motor imparting rotary motion to the same.

Referring more particularly to the above drawings in view of making this description clear and comprehensive, the air-craft embodying the present invention is shown as comprising a propeller, whose blades of light material are secured by steel stays to

a cross-tree which is mounted on the same shaft below the hub.

Propellers 1 and 2, made of wood have steel flanges 26 by means of which they are keyed respectively to a shaft 14 and to a shaft 15. The latter is a tube of brass, formed with spiral grooves 20, of sufficient length to carry the lubrication substance through its bearing into its casing tube.

The cross-tree 27 is secured to each of the shafts 14 and 15, at equal distances below the propeller hubs, and, is calculated to bear most of the strain of the propeller blades through stays running from its extremities to the several sections of the blades. These blades are formed with a gradually increasing width from their points to $\frac{3}{4}$ of their length inwardly, and, with gradual pitch, viz., from one inch to five at their points, to one inch to three at half radius and two inches to one at the base of the propeller, their shape is so designed as to give the same wind-thrust, although one propeller is revolved to the right and the other to the left.

The telescope shafts 14 and 15, upon which the propellers 1 and 2 are respectively mounted, are secured to the bevel gears 22 and 23 adapted to mesh with pinions 30 and 31, oppositely disposed, which are separately secured to the two motor axles 25 and 24.

The solid bearing 32, fitted against and secured to the interior of the case or housing 16, and, holding a double set of ball-bearings, cones and cups 33, serves as a support for the tube shaft 15 and the gear 23 rigidly mounted thereon. The inner shaft 14, having its end journalled within a solid bearing 34 formed with the casing, serves also as a supporting means for the latter.

About three inches to the right of these bearings the tubular shaft 15 is formed with perforations 35 and 36 through which the oil from the oil chamber is admitted to the spiral grooving 21 formed on the periphery of the inner shaft 14 and extending to the upper end of shaft 15. The motion of this shaft 14 being to the left, the oil is forced upward, "as an auger," to a skimmer cup 18, which is screwed on the extremity of shaft 15, and through which shaft 14 is allowed to pass. The joint between said shaft and said cup is effectively fitted with suitable packing.

Secured to this cup 18 is an oil tube 19, about $\frac{3}{8}$ inches in diameter, affording a passage for the oil, down through the hub of propeller 2, through its flanges 26 and cross-tree 27, from where said oil is discharged into a similar cup 17 and packing ring 56, on shaft 15 which is similarly adjusted to casing 16 serving as a bearing for same. The said shaft 15 is provided with spiral grooving 20 suited to force the oil down through casing 16, which acts as a bearing, into the bulged out portion of said casing which serves as an oil chamber 37.

Any style of motor 10 may be used to operate the mechanism of the air-craft embodying this invention. A projection secured to each side extremity of same and curved backwardly, serves as rear feet or rest 29 of the machine. A similar projection curving upwardly and oppositely to said projection 29, engages with the latter both ends of a slide bar 11, substantially parallel with the propeller shaft. This arrangement is effected on both lateral sides of the motor 10. A pulley 40 is mounted at each end of these slides 11, and with the two pulleys 38 and 39, one on each side, the adjustment of the steering cables 6 and 7, is provided for. The said steering cables 6 and 7 are secured with a winding to the steering drums 8 and 9 to the sliding heads 4. The drum 8 has connection with a tube which is secured to a steering wheel 13′. A bearing 50 located between drum 8 and wheel 13′, is secured to side braces from the casing below and forms a bearing for the inner shaft engaging the upper steering wheel 13 and lower drum 9, resting in a bearing on the casing beneath.

The lower steering wheel 13′ is allowed end-play so that it can be gripped by hand separately without interference with the other wheel 13, or raised and gripped with said upper wheel 13 when so required.

A key is adapted to enter a ratchet on lower wheel ferrule for the purpose of locking it to the inner shaft at any point.

After locking said steering wheels they are still adapted to be moved to the right or left. If moved to the right it will increase equal pitch on the whole plane, and if moved to the left, will decrease pitch equally on same. Once the machine has attained the desired altitude, these may be locked during the whole voyage, as all veering is overcome at the time of locking and the machine at voyage speed can only vary upward and downward and this is governed by turning steering wheels 13 and 13′ to right and left.

When it is required to change the course to a right angle, operator should turn wheels 13 and 13′ together to the left, then release the lower wheel 13′ and turn it to the right and back to same position. Again, when the machine has thus been effectively veered to right angle, the wheels 13 and 13′ are to be locked and turned to the right for levelling. (See steering cable in Figure 1).

The arms 5 of the steering plane 3 are hinged to the sliding heads 4, and their upper ends, at their junction with the plane are stayed to the top end of tubular casing or bearing 16 by means of steel cables 51, thereby hinging and associating the steering

plane with the play of the steering device. In furtherance of same, provision is also made to the effect that, in case there is failure on the part of the engine or power, the whole plane will glide forward till it reaches the tubular casing and will then still serve to effect the safe landing of the machine right side up.

A seat 12 hinged to the motor top heads has an extension on its base from either side of same. This extension is engaged by a cable 48 connecting it with the adjustment of road wheel 49, thereby causing the said seat to be automatically adjusted level.

A levelling wheel 55, secured to bearing 50 with a worm gear and drum, serves the purpose of raising and lowering front road wheel 49 which is hinged to the motor base by arms 52 and to the upper casing by arms 53 and 54.

A wind-shield 41 is mounted on motors 10 and casing 16 and one pneumatic road wheel is adjustably mounted in front, while the two rear feet or rests are stationary.

The aggregate surface of all four blades of the herein referred to propellers forms in total 30 square feet, while the steering plane has a surface of 32 feet.

Referring now more particularly to the illustration embodied in Figure 1, the latter clearly shows a steering element and its plurality of members. As shown these are in a position to cause veering to the right, which is effected by having increased pitch to the right, whereby a steering cable, connecting by means of pulley blocks, the drum of this wheel to the sliding arm, as drawn forward the right arm 5, and, this arm being stayed to the plane changes its pitch accordingly: turn to the left to veer to the left. When the desired elevation is attained by the machine, with the destination point in front of same, and no veering evident, both steering wheels are locked together, and turned to the right, thus increasing the pitch equally on both sides and accordingly lifting the rear to the desired position or nearly horizontal. It is obvious that in this position all the weight is borne by the steering plane, and power must be reduced or the machine will attain terrific speed. Thus 80% of the power, propeller speed and fuel, may be utilized economically for long flights.

In Figure 2 where the machine is shown in a nearly horizontal position, is also clearly shown an action of the steering plane in relation with the arms 5 adapted to be oscillated backward and forward on its slides 4, and, the steering element.

For the purpose of causing a curving course of the flying machine when the steering wheels are locked for horizontal flight, without altering the pitch of either end of the steering plane, a steering rudder and tiller 57 is provided for which is pivotally secured to the motor case 10 by means of bracket bearings 58. This contrivance is located sufficiently to the left of the road wheel to assure freedom of motion. The tiller or handle is operated either by the hand or knees of the pilot.

Referring now more particularly to Figure 7, another way is shown of applying power by battery to the same principle. The propellers and motors are combined and at the same time form the hubs of twin propellers. Upon the respective hub portions of the propellers, circular solenoids 1′, 2′, 3′, 4′, 5′, 6′, 7′ and 8′ are arranged, and with energization, the magnetic flux created thereby will effect rotation of the same in opposite directions, as is the case with the well known type of rotary electric motors. Thus, it will be appreciated that motive means for the respective propellers are arranged directly upon their hub portions and in consequence, the use of gearing or kindred connections for transmitting motion to the propellers and by consequence, increasing friction as well as decreasing the speed efficiency of the propellers will be eliminated.

The numeral designations in this Figure 7 are to be described as follows: Numeral 60 illustrates adjusting nuts for packing ring; 61 designates brushes; 62, a commutator; 63, a brush holder, and 64 rings secured to bearing to carry separate electrodes to battery.

While I have described and illustrated one form of carrying my invention into practice, it is, however, understood that various changes in the details of construction and the arrangement of parts may be resorted to, without departing from the spirit of the invention as set forth in the following claims.

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

1. In a vertical flying machine, the combination of two propellers adapted to revolve in opposite direction to each other, the said propellers provided with a plurality of blades, said blades having a pitch designed to give wind-thrust in the same rearward direction and having their surfaces gradually increasing from their extreme points to one half of their length inwardly, the said pitch of same gradually increasing from one inch to five at their points to one inch to three at half radius and two inches to one at propeller's centre hub, each of said propellers being mounted on the same axis, substantially as described and for the purpose specified.

2. In a vertically ascending and descending flying machine, a multiple-steering-plane adapted to engage the wind-thrust of said machine clear across its current, means for changing the pitch of said plane at either of its ends to cause veering and at both ends equally to lift the rear to a sub-

stantially horizontal position, thus causing it to assume the function of a monoplane.

3. In a vertically ascending and descending flying machine, a multiple steering-plane adapted to engage the wind-thrust of said machine clear across its current, a separate operating wheel drum and cable provided for changing its pitch at either end to cause veering, said wheel drums adapted to be locked together for the purpose of thereby arresting all veering, the said wheels when locked together adapted to be handled as a single wheel for the purpose of guiding the machine in flight horizontally, substantially as described and for the purpose specified.

4. In a flying machine, opposed oppositely rotatable propellers including blades whose surfaces increase inwardly in width and in pitch, reversely rotatable motor elements secured to the hub portions of said propellers, a plurality of telescoped lubricating journals for said motor elements, a steering plane arranged above the propellers in a manner to engage the wind-thrust entirely across its current, struts for supporting said steering plane hingedly and slidably connected to the fuselage of the machine, means connected to said struts for oscillating the same individually or collectively and either forwardly or backwardly, and adjustable carriage means secured to the machine fuselage adapted to permit the same to traverse an uneven terraine surface.

5. In a flying machine, the combination of a pair of oppositely rotatable propellers, the blade surface of said propellers increasing inwardly in width and pitch, and reversely rotating motor elements secured to the hub portions of said propellers and adapted to inter-function as and for the purpose set forth.

6. In a vertical flying machine, the combination of oppositely driven direct-thrust twin propellers, the pitch of the blades of same gradually increasing from their points to the centre of said twin-propellers, said propellers being provided with magnets in each hub, serving as a motor, the said blades reinforced by steel stays, said twin-propellers mounted on a self-oiling oppositely driven telescoped twin-shaft.

7. In a flying machine, a duplex oppositely driven direct-thrust twin-propeller, whose pitch of blades gradually increase from their points to propeller centre and are reinforced by steel stays engaging cross trees beneath, magnets in each hub of said propellers adapted to serve as a motor, said propellers mounted on self-oiling oppositely driven telescoped twin-shafts, whose inner member is projecting at both ends and is made with spiral grooves to force oil upwards to a skimmer cup from where it is carried to propeller and connections, an oil tube secured to said skimmer cup and leading through the hubs of said propellers on the outer member to which the cup and tube are secured to the casing tube and through which the outer member projects for propeller connections.

In witness whereof I have hereunto set my hand.

GEORGE EVENLY MOIR.

Witnesses:
R. G. MacIntyre,
M. Adams.