

Jan. 17, 1928.

1,656,492

R. J. L. MOINEAU

FLYING MACHINE

Filed March 19, 1925

3 Sheets-Sheet 1

Fig.1

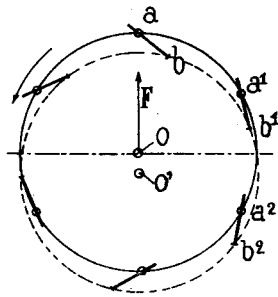


Fig.2

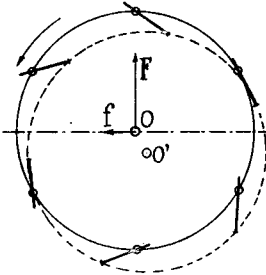


Fig.3

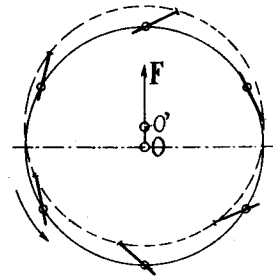


Fig.5

Fig.6

Fig.4

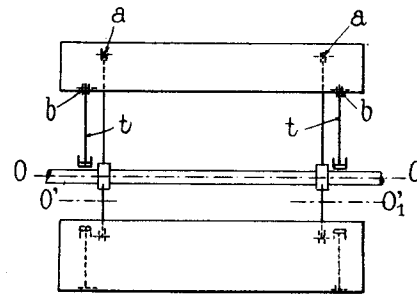
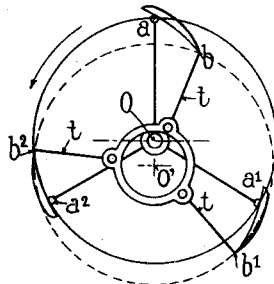
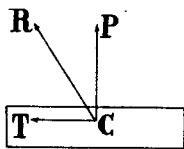


Fig.7

Fig.8

Fig.9

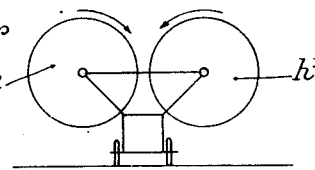
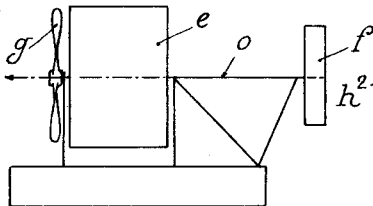
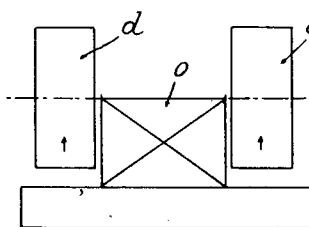
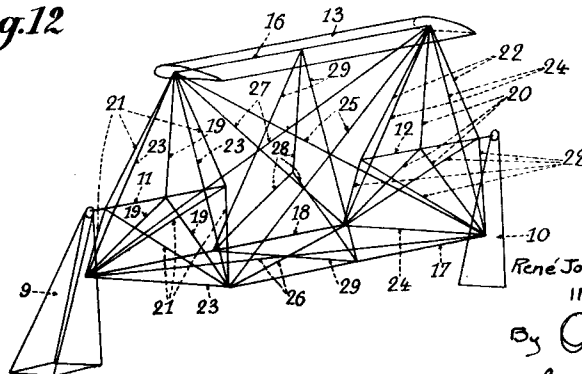


Fig.12



René Joseph Louis Moineau
INVENTOR

By *Otto Meink*
his ATTORNEY.

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3 Sheets-Sheet 2

Fig. 10

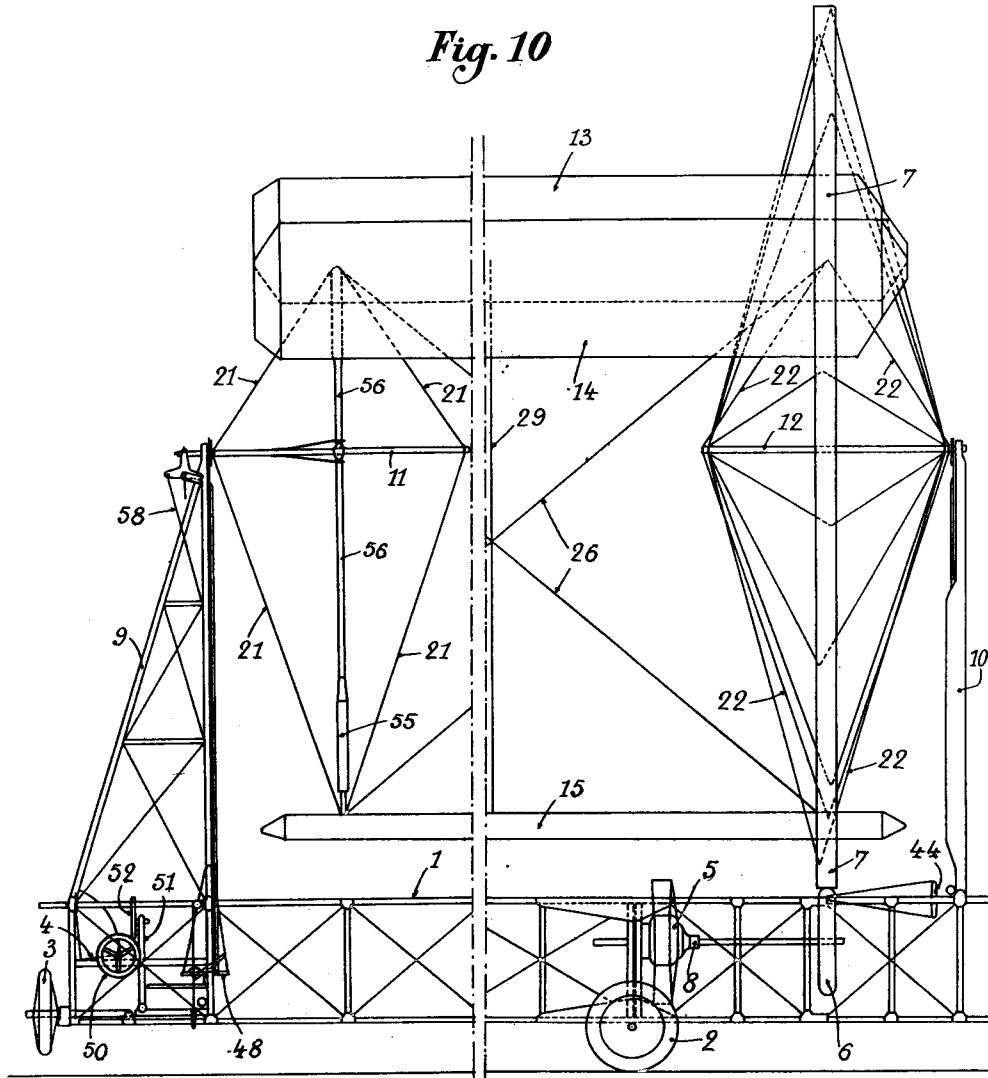
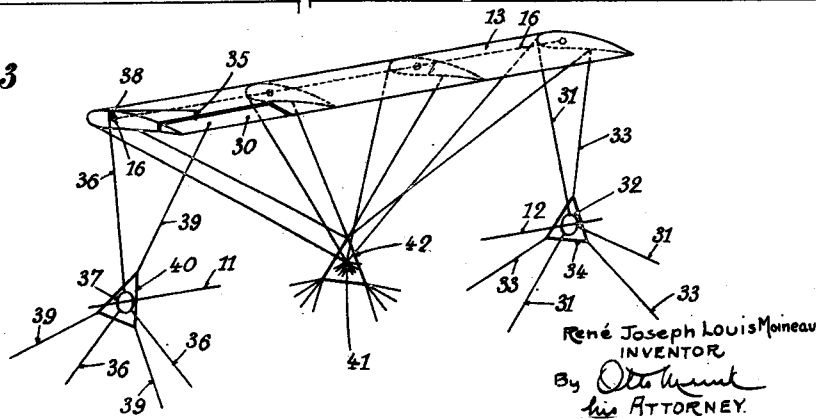


Fig. 13



UNITED STATES PATENT OFFICE.

RENÉ JOSEPH LOUIS MOINEAU, OF PARIS, FRANCE.

FLYING MACHINE.

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The present invention relates to an arrangement adapted to provide for the lifting, the propulsion, the stabilization and the steering of a flying machine.

5 The object of the invention is to obtain, for speeds relative to the air which are variable within wide limits both as to magnitude and direction, firstly a suitable lifting effect, irrespectively of the power employed
10 which may vary from zero to the maximum power of the engine, and secondly the proper stability, in which case vertical or horizontal efforts may be instantly applied to the axis of the machine, said efforts being
15 either of an equal value and acting in the same direction throughout the whole length of the machine, or acting in different directions at the front or at the rear of the machine. As will be hereinafter set forth, such
20 efforts will be sufficient for stabilizing and steering the flying machine according to the invention.

For this purpose the flying machine according to the invention comprises one or
25 more paddle wheels, the axis and the paddles whereof are substantially parallel to the path of the flying machine, means being provided for causing the incidence of the paddles to oscillate during each revolution
30 of the wheel.

In the appended drawings and by way of example:

35 Figs. 1, 2, 3 and 4 are diagrammatic views illustrating the operation of the paddle wheel.

Fig. 5 is an end view of a wheel according to the invention comprising three paddles, and

Fig. 6 is a corresponding elevation.

40 Figs. 7 and 8 are diagrammatic elevational views of modified constructions of the flying machine.

Fig. 9 is a diagrammatic front view of another arrangement.

45 Figs. 10 and 11 are respectively side and front elevational views of a practical construction of a flying machine according to the invention.

50 Fig. 12 is a diagrammatic perspective view showing the construction of the paddle wheel.

Fig. 13 is a like view showing the control arrangement for the inclination of the paddles and their flaps, and

55 Fig. 14 is a like view showing the general

arrangement of the controls disposed within reach of the pilot.

Figs. 1, 2 and 3 show cross sections of paddle wheels whose axes are perpendicular to the plane of the figure. In Fig. 1, o is the main axis of the paddle wheel, and $a-b$, a_1-b_1 , a_2-b_2 etc. are cross sections of the paddles which are rotatable about o . Let it be supposed that the centres of thrust a_1 , a_2 etc. of the paddles are situated upon a circle
60 whose centre is o and that the rear edges b_1 , b_2 etc. are situated upon another circle whose centre is o' ; if o' is ecentered relatively to o , for instance as in Fig. 1, in which it is placed below o , the paddles will
65 oscillate about their axes a_1 and a_2 and each paddle will have an incidence which is zero for the right and left positions of the paddle, and is of maximum value for the top
70 and bottom positions. If the wheel thus constituted is rotated in the air about its axis o , a resultant vertical force F will be obtained and this force will be the sum of the vertical projections of the elementary
75 lifting force for each incidence. The power required to rotate the wheel will be the power necessary to overcome the sum of the elementary resistances.

If o' is ecentered relatively to o and is situated below and to the right of the same
80 (Fig. 2) the resultant will be in like manner a vertical force F , but there will also be produced a horizontal stress in the direction of the arrow f . If the power of the engine has a zero value, by ecentering o'
85 relatively to o and placing it above the same (Fig. 3) the wheel will be subjected to autorotation, i. e. will rotate by its own means, thus producing a vertical force F in the
90 same conditions as above mentioned, since each paddle element will now act as the wing of an aeroplane in gliding flight.

It is obvious that F should be equal to the weight of the machine, save for vertical accelerations. A given incidence will correspond to a necessary power which is the
100 sum of the power furnished by the engine and of the power furnished by the weight of the machine, the latter being positive when descending and negative when rising. Also, the kinetic energy of the parts in rotation will add to the available power, and for instance when landing.

105 If a wheel element as above described is caused to move in the air upon a path which
110

is substantially parallel to the axis of the wheel, the operation will remain the same, and the speed in the direction of the said path will be compounded with the speed of rotation.

Fig. 4 shows a plan view of a paddle; the sector C P represents the periphery speed of the wheel, C T the speed in the direction of the path, and C R the resultant of these speeds. The whole action will take place as above described.

In order to obtain the desired translation of the wheel, it may be drawn by suitable means, for instance by a propeller, or giving the axis o of the wheel a normally inclined position. A certain amount of power is required for carrying out this translation but all the preceding considerations remain valid. The kinetic energy of the machine which is due to the horizontal component of the speed may also be a source of additional power which can be utilized for instance when landing.

Figs. 5 and 6 show respective side and end views of a wheel with three paddles operating according to the invention; it is observed that the eccentric position of the axis $o' o'_1$ need not be the same at the front and at the rear of the wheel, and in this event the blades or wings can be warped, and new properties will be thus obtained.

If the eccentricities at the front o' and the rear o'_1 are vertical and different, this will afford a couple in the vertical plane passing through the axis; a like difference, but both eccentricities being horizontal, will afford a couple in the horizontal plane passing through the axis. These couples may be utilized in a manner which is analogous to the use of the controls (elevator and rudder) of aeroplanes, taking due account of the gyroscopic effect. It will be observed that since the moment of inertia of the wheel is J and its angular speed Ω in order to move the axis at an angular speed ω , it will be necessary to produce a couple C situated in plane perpendicular to the displacement of said axis. This couple will be of large value for a small value of ω , so that the result will be a great stability for the direction of the axis; the rising or descending and the steering effects can be either combined or inverted.

Figs. 5 and 6 show three warping paddles or wings which are connected with the main shaft o of the wheel. Each paddle may oscillate on the axes a, a_1, a_2 ; the rear part b, b_1, b_2 of each wing are connected by rods t with the outer ring of a ball bearing o' and with the outer ring of a second ball bearing o'_1 . By acting upon the eccentricity of the said bearings relatively to shaft o , the pilot can obtain different values of F and f (Figs. 1, 2 and 3) upon the whole of the wing or differentially between the front and rear of the flying machine,

Figs. 7 and 8, which are given by way of example, are two diagrammatic views showing other arrangements employing the paddle wheel.

Fig. 7 is a side view of a machine in which two like wheels and $d d^1$ are mounted upon the common shaft o , one in front and the other at the rear; the eccentricity of each wheel is under separate control, and the wings need not be warped.

Fig. 8 is a side view of a machine in which two wheels of very unequal size are mounted upon the common shaft o ; herein the controls may be somewhat different; the control of the main wheel e displaces the centre of gravity, and the control of the rear wheel f causes the machine to pivot about this centre. The figure shows also by way of example a propeller g which may be unclutched or has a variable pitch, it being mounted on the common shaft together with the wheels.

Fig. 9 is a front view of a machine comprising two like paddle wheels h^1 and h^2 turning in opposite directions; the lateral equilibrium of the machine may thus be controlled and the gyrostatic effects need be considered only as concerns internal stresses.

It is obvious that without modifying the invention, all the known methods for varying the incidence of the chord of a wing, such as variable curvature, wing flaps and the like may be employed.

The paddle wheel may also be provided with any number of paddles or wings, and said paddles may be arranged upon one and the same cylindrical surface, their cross-sections may have any desired shape, and they may all be alike or not.

In like manner, a flying machine may comprise one or more of the above-mentioned paddle wheels, of similar or different construction and rotating in the same direction or in contrary directions, or the like. The machine may further comprise rudder fins, propellers, and like devices, in suitable number and disposition.

A flying machine according to the invention will be stable about its centre of gravity and with the engine running it may remain stationary in the air or may follow any desired path; with the engine stopped it may descend in the vertical or any inclined direction. It should be noted that the kinetic energy of the parts in rotation and of the machine itself, may be utilized momentarily as additional power, for instance when landing.

By way of example, Figs. 10 to 14 show a practical construction of a flying machine embodying the characteristic features according to the invention and in which the fuselage is suspended to the paddle wheel.

The machine herein represented comprises a fuselage or main body 1 which consists of

a triangular structure mounted near the front part upon a two-wheeled flexible chassis 2 and at the rear upon a flexible support consisting of a transverse wheel 3.

5 At the rear of the fuselage is disposed the pilot's seat 4 as well as the various controls which will be further described; the engine 5 is mounted in the front part, and in such manner that the centre of gravity of
10 the machine will be situated below the middle of the paddle wheel. The engine drives a wheel 6 which actuates, for example by friction, a large wheel 7; the latter is provided with wire spokes after the manner of a
15 bicycle wheel and has a larger diameter than the paddle wheel.

A one way device: ratchet clutch or the like—either automatic or positively controlled—is interposed at 8 between the engine 5 and the small wheel 6, so that the said wheel may be driven by the engine, but the engine shall not be driven by the paddle wheel, for instance in case of a breakdown.

At the rear of the main body is mounted a tower 9 and at the front a tower 10 which consists of two masts joined at the top; the masts of the tower 10 are not rigidly connected with the fuselage, in order to allow for the wear and the distortion of the paddle wheel and of the said fuselage. At the top of each tower 9 and 10 is disposed a ball bearing which is preferably mounted on a ball joint, and in the respective bearings are mounted in overhang the shafts 11 and 12
35 which are disposed in line and constitute the axis of the said paddle wheel; the shaft 12 also forms the axis of the wheel 7, and the ends of the wheel spokes are attached to the ends of said shaft.

40 The paddle wheel comprises three paddles or blades 13, 14 and 15 whereof the transverse ribs are mounted on respective rods or tubes 16, 17, 18 situated near the centres of gravity and of thrust. The said tubes, upon which the blades are adapted to pivot
45 with very easy friction, are secured at the ends of the arms 19 and 20 which are spaced at 120 degrees and are respectively perpendicular to the shafts 11 and 12 to whose middle part they are secured.

50 The outer ends of the arms 19 are connected with the ends of the shaft 11 by the wires 21; the ends of the arms 20 are connected to the ends of the shaft 12 by the wires 22. The said ends of the arms 19 and 20 are also connected together in the planes of said arms by the respective wires 23 and 24. In the planes of the tubes 16 and 17, 17 and 18, 18 and 16, the ends of the arms
60 19 and 20 are respectively connected by the crossed wires 25, 26, 27.

Should the said paddle wheel have a relatively great length, I prefer to complete the above-described connections by an arrangement of wires disposed in the middle trans-

verse plane or even in several transverse planes, said arrangement comprising radial wires 28 and wires 29 which are parallel to the wires 23 and 24. With this disposition, the paddles will not be subjected to centrifugal effects.

The construction of a paddle is analogous to that of an aeroplane wing, except that the calculations for strength should take account of the centrifugal effects due to the rotation of the paddle wheel. The ribs are threaded upon the tubes 16, 17, 18 which should be disposed near the centre of gravity and of thrust, and small ball bearings or like bearings are interposed between the said tubes and ribs and chiefly for the ribs which are adjacent the arms 19 and 20 and are situated in the plane of the intermediate connecting arrangements, comprising the wires 28 and 29. In the machine herein described, the paddles are supposed to be rigid and each comprises a wing flap 30 which is disposed at the rear of the machine.

Fig. 13 shows the means which may be employed for the control of the pivoting movement of the paddles and their flaps, only a single paddle 13 being shown for the sake of clearness.

At the front part of the paddle wheel, the front edge of a rib of each blade is connected by a wire 31 to the outer ring of a large ball bearing 32 which surrounds the shaft 12 at some distance therefrom, the three wires 31 being spaced by 120 degrees.

Wires 33 connect the rear part of the said ribs with a suitable rigid element 34 which has for example a triangular shape; the said element is quite free, being supported only by the wires 33, and it provides, by means of the latter, for the corresponding pivoting movements of the three paddles 13, 14, 15 of the wheel according to the eccentricity of the ball bearing 32 relatively to the shaft 12.

The flaps 30, of a construction known per se, are each provided with a small swing bar 35; said bars are connected by wires 36 with the outer ring of a large ball bearing 37 which surrounds the shaft 11 at some distance therefrom, said wires being wound upon small pulley 38 in proximity to the tubes 16, 17, 18. The wires 39 connect the rear edges of the said flaps with a loosely mounted triangular member 40.

Due to the eccentric positions of the bearing 32 relatively to the shaft 12 and of the bearing 37 relatively to the shaft 11, the paddles with their flaps will pivot about, and the said flaps will also be pivoted relatively to the paddle. Since the paddles are controlled at one end, I may, in order to obviate or at least reduce the torsion thus produced, connect the front parts of certain ribs of all the paddles with a central element 41 of the said wheel by oblique wires, and also connect the rear parts of the same

ribs with a loosely mounted element 42 analogous to the element 34 by the oblique wires; the contrary arrangement may also be employed, the rear wires being connected with a central element and the front wires to a loose element.

Fig. 14 shows an arrangement comprising various means enabling the pilot to control the eccentricity of the bearings 32 and 37 by acting upon their inner rings.

The inner ring of the bearing 32 is rigidly fixed to the upper end of a mast 43 whose lower end is carried by the swing bar 44 which is pivoted to the fuselage and is guided at the upper part in a guide 45 which is movable upon a small longitudinal axle pin carried by the tower 10.

The inner ring of the bearing 37 is mounted at the upper end of a mast 47 whose lower end is carried by a swing 48 which is pivoted to the fuselage and which is guided at the upper part in a guide 49 which is movable upon a small longitudinal axle pin carried by the tower 9.

The mast 43 and the bearing 32 are raised and lowered by pivoting the bar 44 under the control of the hand wheel which is adjacent the seat 4. In front of the seat is mounted a control stick bar 51 carrying the hand wheel 52; said stick bar is enabled to swing to the front and rear, thus controlling the pivoting motion of the bar 48 and the vertical displacements of the mast 17 and the bearing 37.

The stick bar 51 may also be pivoted laterally, and it thus actuates a swing bar 53 to whose ends are attached the wires 54 controlling the pivoting motion of the guide 45 and hence the inclination of the mast 43 about its lower end. The rotation of the hand wheel 52 will control the pivoting motion of the guide 49 and hence the inclination of the mast 47 about its lower end.

Obviously, the said controls may be disposed in any other suitable manner within reach of the pilot. The above described arrangement will afford the control of the steering by the rotation of the hand wheel 52, the control of the altitude by a lengthwise rocking motion of the stick bar 51, the control of the lateral movement by the lateral rocking motion of the same bar, and the control of the incidence by the use of the hand wheel 50, but account must be taken of possible disturbances occasioned by gyrostatic effects due to the rotation of the paddle wheel.

Fig. 11 shows three small flat members 55 mounted upon tubes 56 which are threaded upon the radial arms 19, thus constituting a propeller whose pitch may be adjusted by rotating the tubes 56 upon the said arms; said rotation may be controlled for example by the pedal 57 which acts by means of a suitable swing bar upon two wires 58 ac-

tuating swing bars, not shown, which are disposed upon the tubes 56 adjacent the shaft 11. The pilot may control the engine 5 by means of the pedal 59.

In the above construction the reaction due to the rotation of the wheel is counter-balanced by a lateral inclination of the fuselage constituting a pendulum.

Obviously, the said invention is not limited to the constructional forms herein described and illustrated, these being given solely by way of example.

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

1. In a flying machine the combination of one or more paddle wheels the axis and the paddles whereof are substantially parallel to the path of the flying machine, each of said paddles being adapted to swing about a longitudinal axis situated at a constant distance from the shaft of the corresponding wheel, means for warping said paddles, a rotatable support, means for eccentricing the axis of rotation of said support relatively to said wheel, means for inclining said axis upon the wheel shaft and means for operatively connecting said support to one edge of the paddles of said wheel.

2. In a flying machine the combination of a longitudinal shaft, a plurality of paddle wheels mounted on said shaft, each paddle of said wheels being adapted to swing about a longitudinal axis situated at a constant distance from said shaft, a rotatable support for each wheel and eccentricing with respect to the corresponding wheel, means for varying the eccentricity of each support independently of the others and means for operatively connecting each support to one edge of the paddles of the corresponding wheel.

3. In a flying machine the combination of one or more paddle wheels the axis and the paddles whereof are substantially parallel to the path of the flying machine, means whereby the incidence of the paddles is caused to oscillate during each revolution of said wheels, means for rotating said wheel or wheels and a one way device interposed between said rotating means and said wheels and whereby any driving action from said wheels to said rotating means is prevented.

4. In a flying machine the combination of one or more paddle wheels, the axis and the paddles whereof are substantially parallel to the path of the flying machine, each wheel comprising two sets of radial arms respectively disposed at the ends of the wheel, longitudinal rods connecting the arms of one set to the arms of the other set, the paddles of the wheel being adapted to swing respectively about said rods, two longitudinal shafts upon which the inner ends of said arms are secured, two vertical supports upon which said shafts are respectively pivoted,

a stay wire system whereby the rigidity of the wheel is insured, and means for imparting to the paddles of said wheel or wheels a swinging motion about said longitudinal rods.

5. In a flying machine as claimed in claim 4 the further feature residing in that one at least of said vertical supports is pivoted to the fuselage of the machine.

6. In a flying machine as claimed in claim 4, the provision of blades respectively and adjustably supported by said radial arms and whereby a propeller with adjustable pitch is constituted.

7. In a flying machine as claimed in claim 4, the provision of flaps respectively pivoted to said paddles and means for operating said flaps.

8. In a flying machine the combination of one or more paddle wheels the axis and the paddles whereof are substantially parallel to the path of the flying machine, means operatively connected at one end of the paddles of said wheel or wheels for imparting to each paddle a swinging motion about an axis parallel to the wheel axis, flaps respectively pivoted at the opposite end of the paddles and means for operating said flaps.

9. In a flying machine as claimed in claim 4, the further features residing in that said swinging means comprise in combination whereof is operatively connected with one edge of the wheel paddles, a vertical post supporting the inner ring of said bearing, a swing bar adapted to be operated by the pilot and supporting the lower end of said post, a guide for the upper part of said post and pivoted to one of said vertical supports for the paddle wheel and means for controlling the angular position of said guide.

10. In a flying machine the combination of one or more paddle wheels, the axis and the paddles of each wheel being substantially parallel to the path of the flying machine, each paddle being adapted to swing about a longitudinal axis, a rotatable ring like support eccentric with respect to said wheel and adapted to assume any eccentric position all around the axis of said wheel and means for operatively connecting said support to one edge of the paddles of the wheel.

11. In a flying machine the combination

of one or more paddle wheels, the axis and the paddles of each wheel being substantially parallel to the path of the flying machine, each paddle being adapted to swing about a longitudinal axis, a ball bearing eccentric with respect to said wheel and the inner ring whereof is adapted to assume any eccentric position all around the axis of said wheel and means for operatively connecting the outer ring of said ball bearing to one edge of the paddles of the wheel.

12. In a flying machine the combination of one or more paddle wheels, the axis and the paddles of each wheel being substantially parallel to the path of the flying machine, the cross section of each paddle having the shape of an airplane wing and means for imparting to each paddle a swinging motion about an axis parallel to the wheel axis and situated adjacent the thrust line of the paddle and the line of the centres of gravity of the successive cross sections of the same.

13. In a flying machine the combination of one or more paddle wheels, the axis and the paddles of each wheel being substantially parallel to the path of the flying machine, each paddle being adapted to swing about a longitudinal axis, two rotatable ring like supports for each wheel and respectively disposed substantially at each end of the wheel, each of said supports being eccentric with respect to said wheel and adapted to assume any eccentric position all around the axis of said wheel, means for operatively connecting each support to one edge of the paddles of the wheel and means for controlling the eccentricity of said supports independently of one another.

14. In a flying machine the combination of two longitudinal shafts, two paddle wheels respectively mounted on said shafts, each paddle of each wheel being adapted to swing about a longitudinal axis, a rotatable ring like support eccentric with respect to said wheel and adapted to assume any eccentric position all around the axis of said wheel, means for operatively connecting said support to one edge of the paddles of the wheel and means for rotating said wheels in contrary directions.

In testimony whereof I have signed my name to this specification.

RENÉ JOSEPH LOUIS MOINEAU.