F. MICHAU.

FLYING MACHINE.

APPLICATION FILED DEC. 6, 1909.

1,018,205.

Patented Feb. 20, 1912.

3 SHEETS—SHEET 1.

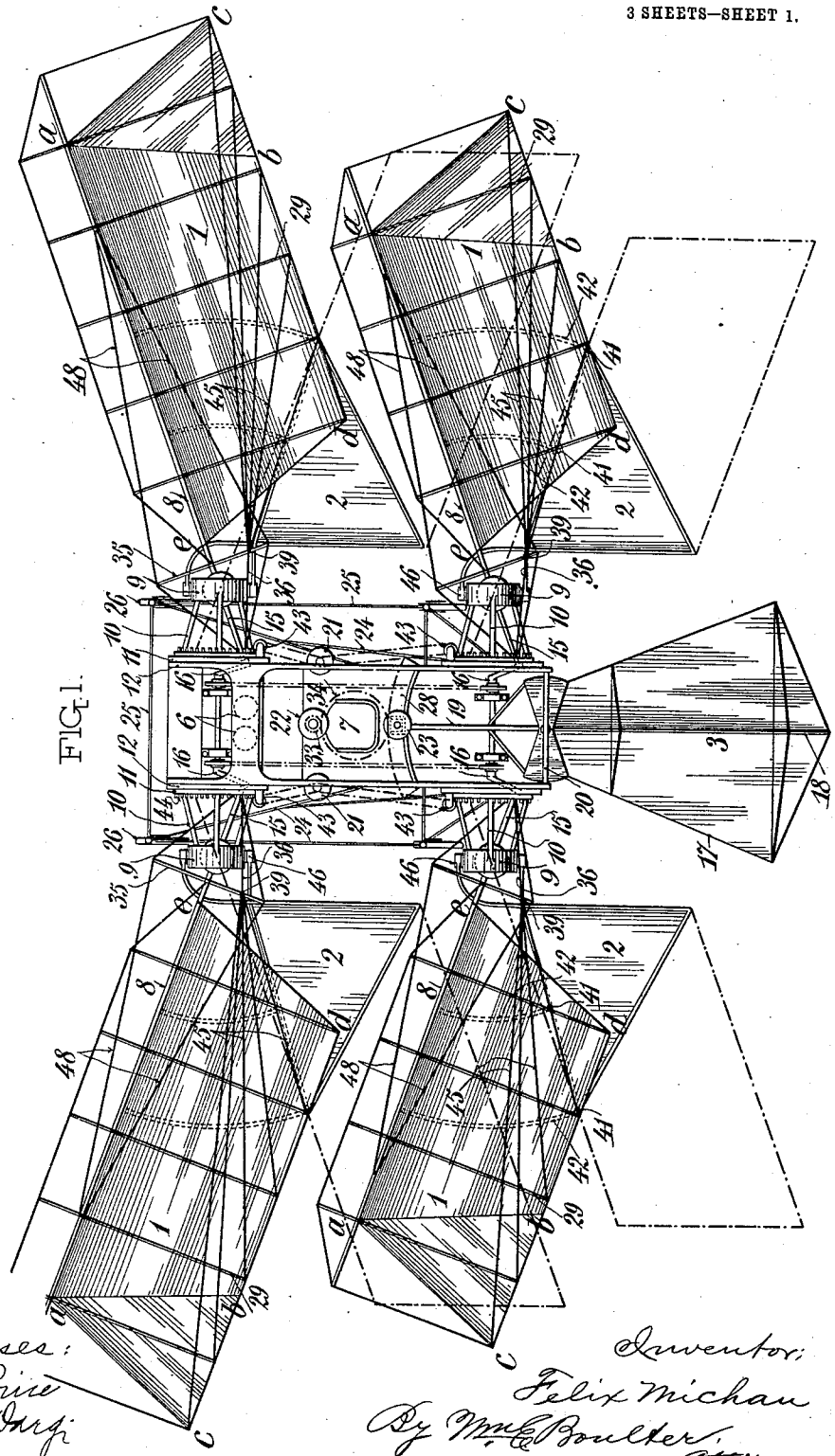

FIG. 1.

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3 SHEETS—SHEET 2.

FIG. 2b.

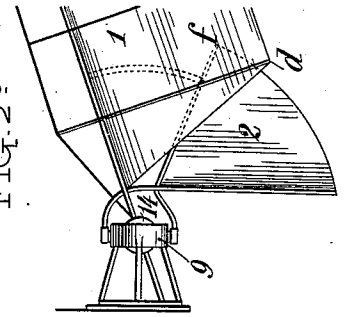


FIG. 2.

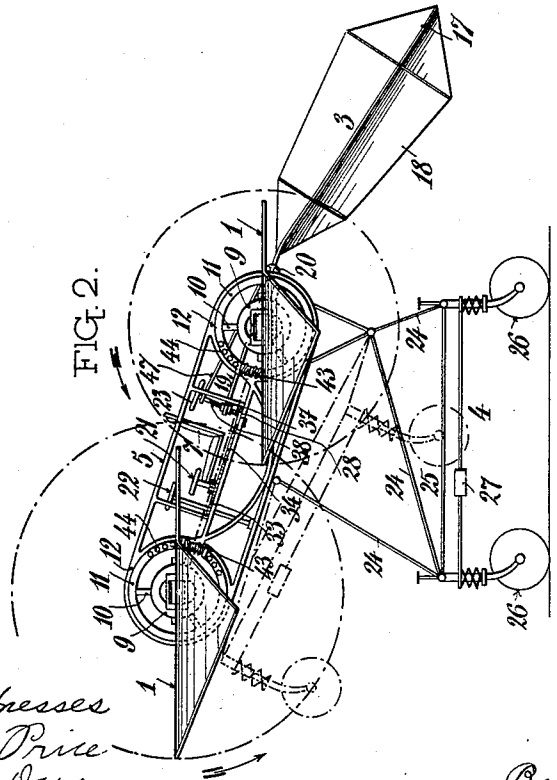
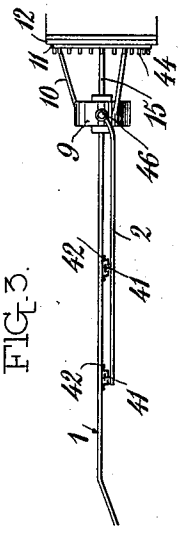


FIG. 3.



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3 SHEETS—SHEET 3.

Fig. 2a.

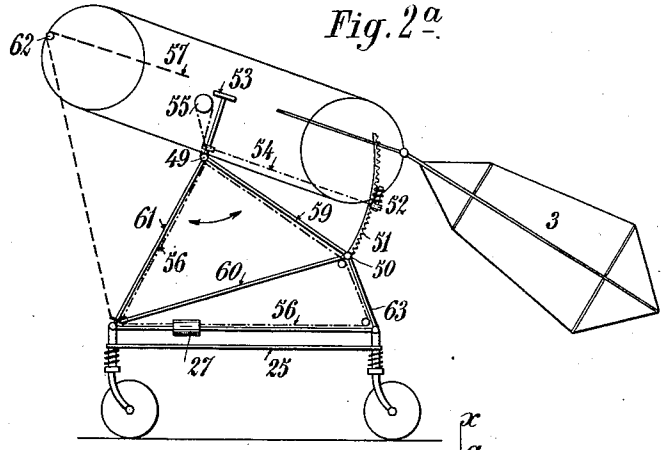


Fig. 4.

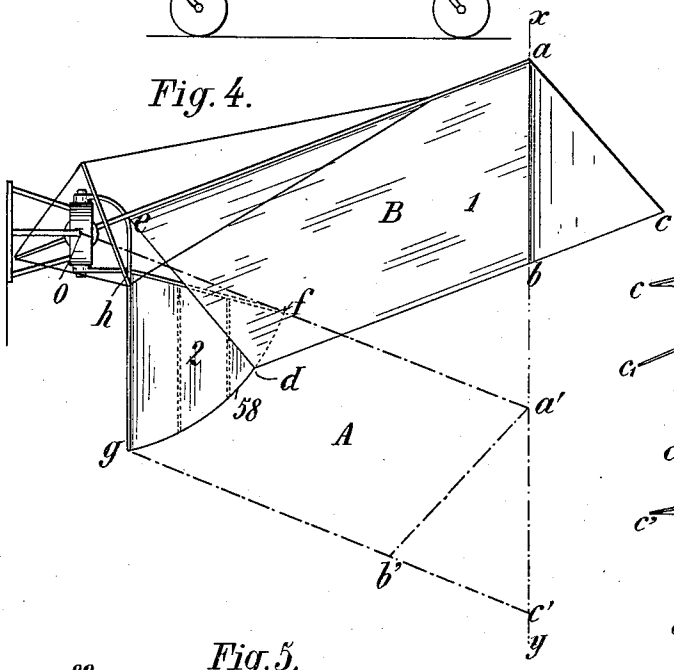


Fig. 4a.

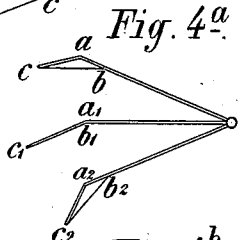


Fig. 4b.

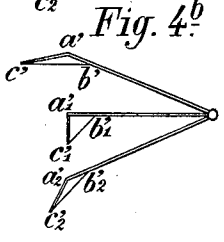


Fig. 5.

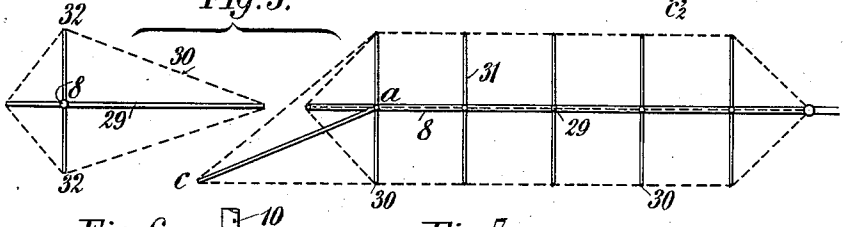


Fig. 6.

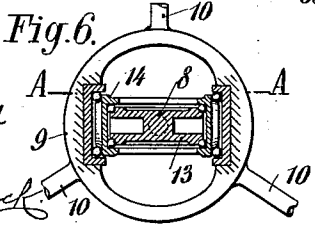
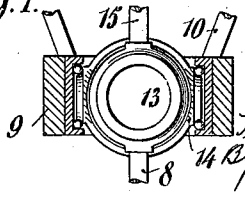


Fig. 7.



Witnesses

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FELIX MICHAU, OF PARIS, FRANCE.

FLYING-MACHINE.

1,018,205. Specification of Letters Patent. Patented Feb. 20, 1912.

Application filed December 6, 1909. Serial No. 531,567.

To all whom it may concern:

Be it known that I, FELIX MICHAU, a citizen of the French Republic, residing at Paris, in France, have invented certain new and useful Improvements in Flying-Machines, of which the following is a specification.

This invention relates to a flying machine operating on the heavier than air principle, the construction of the supporting, propelling and steering parts of which enables the flight of a bird to be imitated.

A construction according to this invention is illustrated by way of example in the accompanying drawing.

Figure 1 is a general plan of the apparatus. Fig. 2 is an elevation showing the apparatus resting on the ground, the dotted lines showing the position which certain of the parts assume in flight. Fig. 2^a is a diagrammatic view similar to that of Fig. 2 showing more particularly a modified construction of the carriage for running the apparatus on the ground. Fig. 2^b is a partial plan of one of the supporting parts of the apparatus in the air, modified relatively to the construction shown in Fig. 1, the winglet 2 being provided with a curved edge. Fig. 3 is a side elevation of a wing and of a small wing or winglet of the apparatus in question. Figs. 4, 4^a and 4^b are diagrammatic views intended to facilitate the understanding of the explanation given below as regards the shape and the movements of evolution of the wings of the apparatus in question. Fig. 5 shows specially in longitudinal and transverse views the shroud device of a wing. Fig. 6 is a vertical section through the joint of one of the wings. Fig. 7 is a horizontal section of the same joint on line A—A of Fig. 6.

If we liken the chief parts of the apparatus to the corresponding ones of a bird, the said parts comprise wings 1, little wings or winglets 2 a tail or rudder 3 and feet or folding running carriage 4. These parts are connected to a body 5 which carries the engine 6 the seat 7 for the aviator, as well as the various parts for controlling the manipulation of the apparatus.

The wings 1 are arranged in pairs, two at the front of the body 5 and two at the back. Each of them is constituted by a rod 8, normal to which are secured other rods 29 or quills which support on one side only of the rod in question, a canvas or any other surface. The said rod 8 is pivoted to a ring 9 supported at a certain distance from the body by converging arms 10 which in their turn, are connected to a ring 11 provided with pins 44 and capable of turning to a certain angle in another circle 12 secured to the said body. The rod 8 is pivoted in such manner that it can describe in space a cone of revolution without being able to rotate about itself. To that end, the said rod 8 passes diametrically through a disk 13 (Figs. 6 and 7) which can rotate in a casing 14 carrying at each of the ends of one of its diameters a pivot pin capable of rotating normally to the casing 14 in the corresponding bearing of the ring 9. Each rod is provided, on one side of its supporting ring 9 that is to say, on the side of the body, with an extension 15 which is given a circular movement by the crank shaft 16 of the engine, either directly or by means of any suitable transmission gear. The operative surface of the wing being arranged, as already stated, only on one of the sides of the rod 8 it follows that each wing strikes the air with a much larger radius in one direction than in the other, since the rod 8 of the wing describes a cone. If we consider the wing rotating in a counterclockwise direction when viewed from the point *o* in Fig. 4, it will be understood that the surface *a b c* travels through a much larger space when it descends than when it rises. Thus the line *x*, *y* represents a vertical plane outside of which the surface *a b c* will descend and inside which it will ascend during one revolution of the wing. The lower part of Fig. 4 shows the wing in the ascending part of its stroke and the upper part shows the wing in the descending part of its stroke. On the other hand, the horizontal projections of the wing in these two positions, differ only as regards the portion *d*, *e*, *g*, which the descending wing does not cover, while the said portion *d*, *e*, *g* is covered by the rising wing. The small wing *h f g* which does not follow the wing in its movement of rotation, but beats with it vertically, has for its object to remedy the disadvantage in question by keeping constant the surface of the portion of the wing situated on the rear side of the vertical plane on line *x*, *y*.

It follows from the preceding that the surface *a b c* of the wing which is on one side of the plane on line *x*, *y*, when the wing is rising, acts as a supporting surface as

soon as it descends again, because at that time it acts beyond the said plane on line x, y. In its evolution the wing when moving forward is unfolded relatively to the winglet and is folded again on the winglet in question when returning backward.

The useful effect produced by the wing for supporting the apparatus in the air, is still further increased by the fact that the end $a\ b\ c$ of the said wing forms a plane inclined downward relatively to the rest a, b, d, e, of its surface

The propulsion may be explained in the following manner. Let us take four positions of the wing at 90° from each other and project them on to a vertical plane perpendicular to the direction of movement of the machine. The inclination of the surfaces $a\ b\ c$ is clearly shown in Figs. 4^a and 4^b of the accompanying sketch, when the wing is lowered and when it is raised. When the wing is being lowered, there will be seen the surface $a\ b\ c$ which forces below it all the air which it strikes, for $b\ c$ is horizontal. The support is therefore obtained by it in its movement of descent, as already stated. The vertical projection of the said surface $a\ b\ c$ decreases on the other hand when the wing advances, and increases when it moves back, which produces the push; which will be understood when $a'\ b'\ c'$ (Fig. 4^a) is compared with $a'_1\ b'_1\ c'_1$ of the descending stroke (Fig. 4^b). These surfaces $a\ b\ c$ act moreover so as to exercise a supporting action when they are moved forward, and a propelling action when they are moved backward, so that they are always useful.

The propulsive effect at each stroke of the wing is determined by the difference between the values of all the vertical projections of the wing situated at the end of one and the same diameter of the circumference of a circle described by the points $a\ a^1\ a^2$, as shown by the positions of the wing when it is horizontal.

A construction of the device in question is illustrated by way of example, in Figs. 1 and 3 and consists in the wing being completed near its joint, by a winglet 2 which moves only with the supporting ring 9 to which it is pivoted at 46 along the plane of the wing, so as to follow the latter and oscillate in a direction normal to the plane of the wing. To that end, the winglet is connected to the wing by tenons 41 with which it is provided and which engage with tracks 42 provided on the wing in question on the bottom surface. The winglet in question is also connected in any suitable manner to the casing 14 which moves with it.

The winglet 2 shown in Fig. 2^b has a curved outline on the side opposite to its joint, and the center of the curve coincides with the center of the ring 9 and of the casing 14, as shown in Fig. 2^b in order that its end f which is the farthest away from the body 5 should never be able to foul the point d of the wing 1.

The accompanying drawing shows that the outlines limiting the surface of the wing, are represented by straight lines, and that the surfaces in question are flat but it is obvious that the said outlines and surfaces could also be curved. The tail or rudder 3 of the apparatus is constituted by two planes 17 and 18 intersecting normally to each other. This rudder can rotate in the horizontal direction, so as to give the proper direction to the apparatus. To that end it is extended on the inner side of its joint by an arm 19 the end of which, held by a rod 47 (Fig. 2) carries a nut 37 through which passes a screw-threaded rod 38 supported by a movable sector 28 the center of rotation of which coincides with that of the rudder, and the plane of which is approximately in the center of the frame of the apparatus. By turning the hand wheel 22 placed in front of him the aviator by means of toothed wheels 33, 34 imparts a movement in the desired direction to the sector 28 which carries with it the arm 19, and consequently the rudder 3. The same rudder can be lowered or raised for inclining the apparatus to a greater or less extent. To that end, the aviator has behind him a hand wheel 23 mounted on the screw-threaded rod 38 which, according as it is rotated in one or in the other direction, causes the rudder 3 to rise or to descend. The latter is guided in its various movements by two cross bars 20 between which pass the portions of a double sector with which it is provided at each side of its joint.

The height to which the apparatus can be raised, will be more or less great according to the speed of beating of the wings and according to their inclination which it will be possible to determine by means of any suitable device for the purpose, such as change speed gear or other mechanism.

The inclination of the wings can be modified at will by rotating their supports 9, either separately or simultaneously by means of one or the other of the hand wheels 21 21 which the aviator has at each side of his seat and which enable him to operate the worms 43 engaging with the pins 44 of the disks 11, for the purpose of rotating the latter with their supports in the desired direction. The disks 11 of the wings situated at one and the same side of the apparatus can be connected together by means of any device which secures them together so that they rotate in the same direction.

In the construction shown in Figs. 1 and 2 the apparatus is provided below the body with a movable support 4 constituted by rods 24 pivoted on the one hand to the said

body, and on the other hand to a frame 25 which is mounted elastically on pivoted wheels 26 which automatically assume the proper direction.

The frame 25 can be brought, by means of a suitable device, against the bottom surface of the body when the apparatus leaves the ground. According as the frame 25 is brought more or less toward the front, it alters the position of the center of gravity of the apparatus which, independently of the similar action of the wings and of the tail enables the apparatus to be more or less inclined during the ascent or descent.

An arrangement for folding the frame 25 is shown in Fig. 2ª and in this figure the framework 59, 60, 61, 63 replaces the rods 24 shown in Fig. 2. Referring to Fig. 2ª a hinged framework 60, 61 and 63 is formed at each side of the apparatus, and the rod 59 is pivoted to the body at the point 49 while the other end of the said rod can be elevated or depressed by the toothed sector 51 gearing with a worm 52 which is operated by the handwheel 53 through the chain 54. The elevation or depression of the rod 59 enables the frame 25 to be more or less inclined relatively to the body. The hinged framework can be folded by means of the cord 57 operated by the driver from his seat, The cord is connected to the front of frame 25 and carried over the pulley 62 arranged in front of the body. The framework is shown folded in dotted lines in Fig. 2. The rod 60 is pivoted at 50 and is provided at its other end with a ring attachment adapted to slide along the rod 61 when the frame is folded. When the apparatus is about to come to the ground, the aviator releases the cord 57; the framework then unfolds and it is obvious that when the apparatus is resting on the ground the weight of the apparatus will wedge the end of the rod 60 firmly at the lower end of rod 61.

The aviator, after having flown, in order to alight, can modify the position of the landing wheels by means of the wheel 53 and chain gearing 54. He can thus increase more or less the angle of incidence of the apparatus at the moment of alighting. When the apparatus rests on the ground, the rear part of the ship must be lifted by any suitable means so that the wing can be operated.

Independently of the two folded and unfolded positions of the frame 25 the latter can be brought into intermediate positions so as to cause the position of the center of gravity of the apparatus to vary, which in addition to the analogous action of a weight 27, enables the wings and the tail to incline the apparatus more or less during flight. The weight 27 is mounted on a longitudinal guide of the frame and can be adjusted thereon by a suitable cord mechanism 55, 56.

The rigidity of the wings is insured by transverse rods or quills 29 which form one body with the rod 8 to which the quills are also connected by shrouds 30, separate for each of the quills from which they are held apart by rods 31 with which the rod 8 is provided normally to the said quills 29 as specially shown in Fig. 5. The shrouded rods 31 are themselves connected together by a shroud 32 arranged longitudinally of the wing and normally to that of 30. Other shrouds 45 arranged below and above the wing start from a rod 39 secured to the bars 35 projecting from a point in Fig. 1 and start from the end of each quill so as to rigidly secure the same. The rod 39 itself is held at the opposite side of the shrouds 45, by an attachment 36 which connects the said rod 39 to the extension 15 of the principal rod 8 of the wing. Other shrouds 48 keep the rod 8 of the wing. The converging arms 10 of the supports of each wing can be curved so as not to interfere with the attachments 36 in the movement of the wing.

What I claim as my invention and desire to secure by Letters Patent is:—

A flying machine comprising a heavy body an engine carried thereby, a seat also carried by said body, and beating wings pivoted to said body, each of said wings comprising a rod, means for causing said rod to describe a conical surface of revolution without rotating about itself, a surface secured to said rod, a second surface connected to the joint of the wing so as to follow the latter in one direction only, said first mentioned surface being inclined at its outer end and unfolded relatively to said second surface, means for rotating the joint of the wings in a vertical plane, means for beating said wings to support the machine during flight, means for steering the machine, together with folding means enabling the machine to start on the ground.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FELIX MICHAU.

Witnesses:
BARTLEY F. YOST,
GEORGES BONNEUIL.