

P. C. HOPKINS.
FLYING MACHINE.
APPLICATION FILED APR. 28, 1906.

1,001,849.

Patented Aug. 29, 1911.

3 SHEETS—SHEET 1.

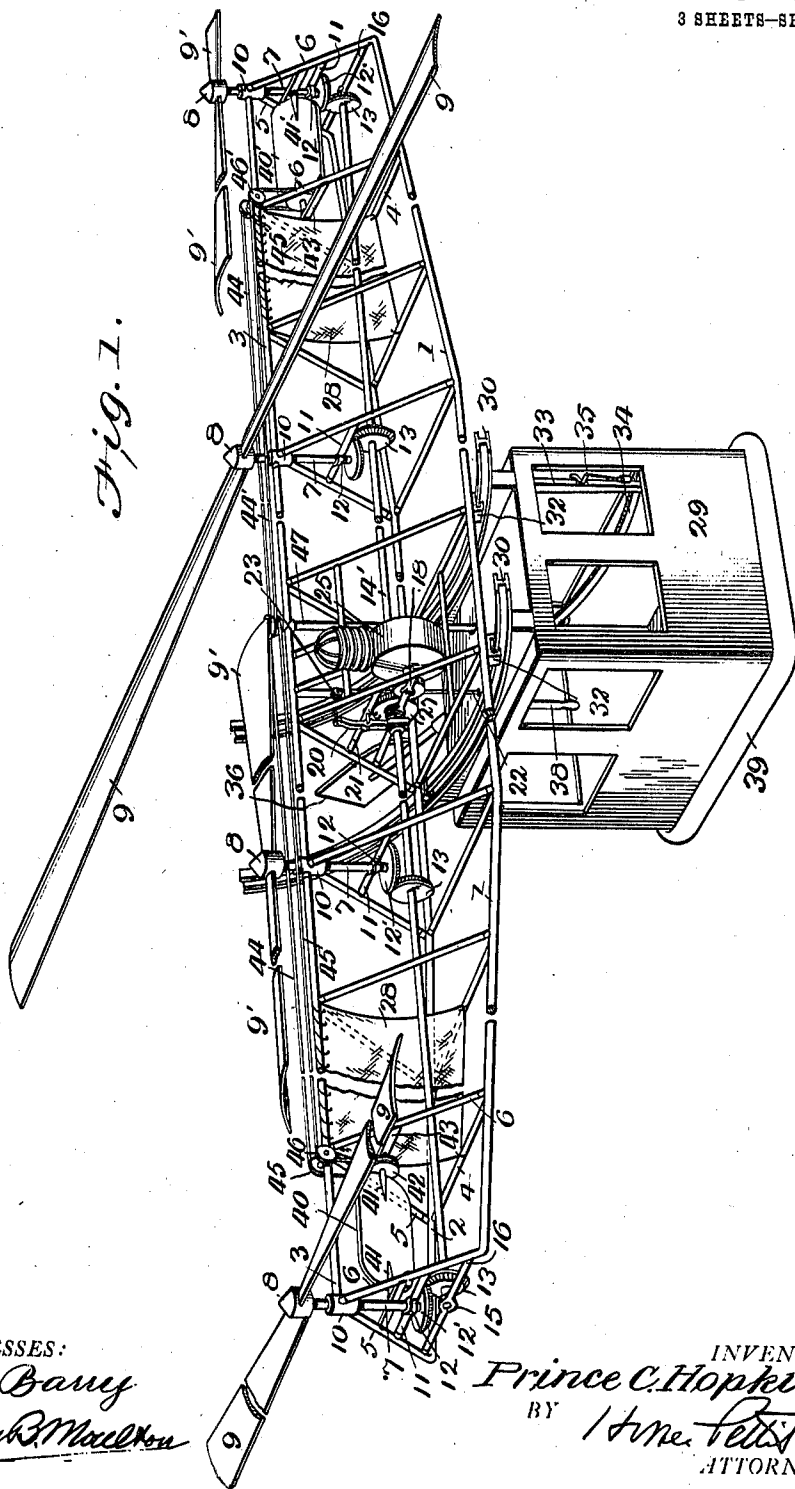


Fig. 1.

WITNESSES:

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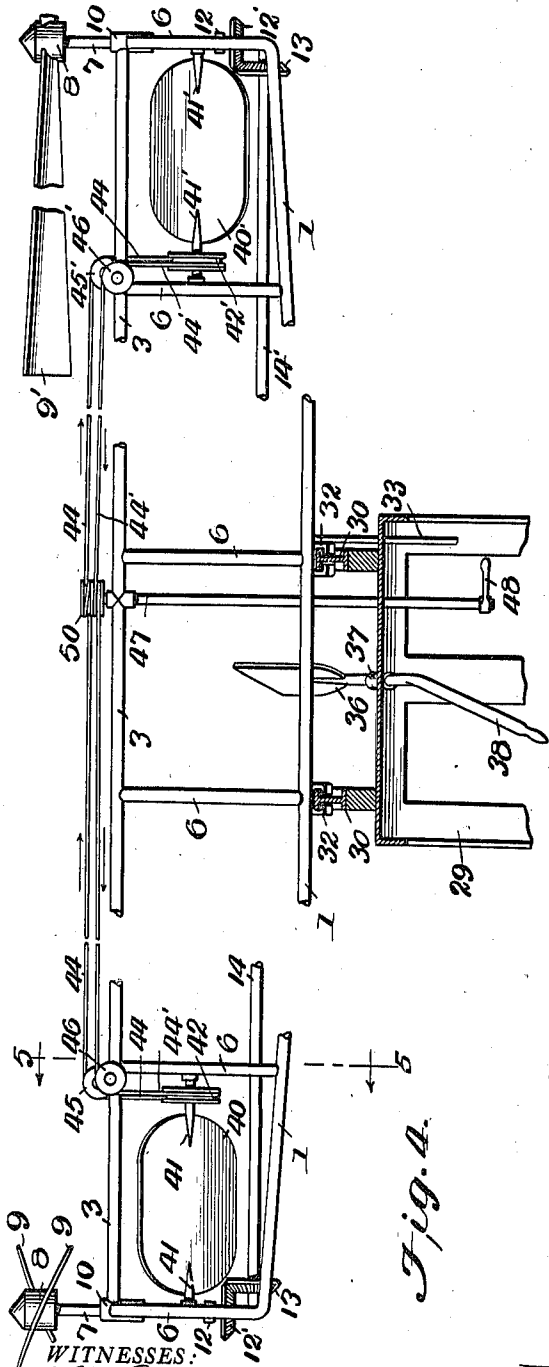
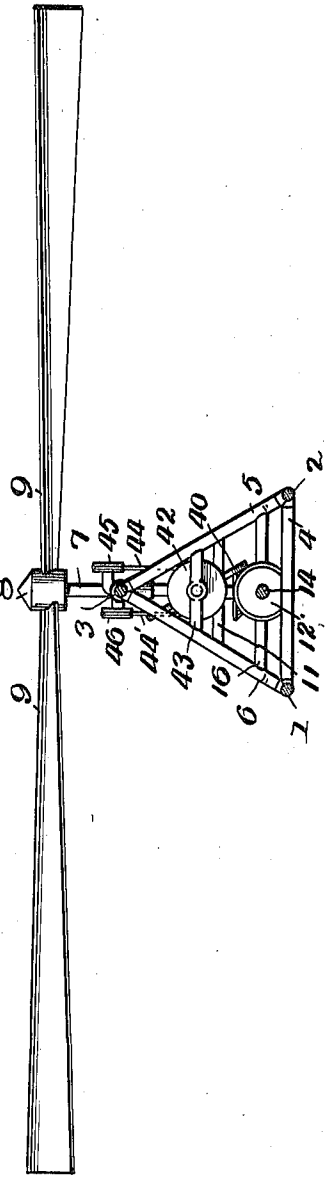


Fig. 4.

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Fig. 5.



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UNITED STATES PATENT OFFICE.

PRINCE C. HOPKINS, OF NEW YORK, N. Y.

FLYING-MACHINE.

1,001,849.

Specification of Letters Patent.

Patented Aug. 29, 1911.

Application filed April 28, 1906. Serial No. 314,119.

To all whom it may concern:

Be it known that I, PRINCE C. HOPKINS, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Flying-Machines, of which the following is a full, clear, and complete disclosure.

My invention relates to machines for navigating air, and particularly to that class of the same in which their elevation and direction are controlled by propeller blades.

The object of my invention is to provide such a machine in which the same means of propulsion may be utilized both for ascension and navigation, and by a peculiar arrangement of the propeller blades to obtain a more efficient means of propulsion and cause the movements of the machine as a whole to be more susceptible to control.

A further object of my invention is to provide a frame and a car so arranged that the frame may be moved relatively to the car to control the direction of the machine.

With these objects in view, my invention consists of the details of construction and manner of operation set forth in the following description and accompanying drawings, in which like reference characters indicate corresponding parts.

In the drawings, Figure 1 is a perspective view of my invention, parts of the frame and propeller blades being broken away; Fig. 2 is a transverse section of the same, showing the car and frame arranged in their normal relative position, and Fig. 3 is a transverse section taken in the same plane as Fig. 2, but showing the frame moved to incline the axes of the propellers. Fig. 4 is an elevation of the frame and car showing the steering gear, but having parts thereof broken away, and Fig. 5 is a cross section taken on line 5-5 of Fig. 4.

Referring particularly to the frame structure, in which the propellers are rotatably journaled, 1 and 2 represent the longitudinal base bars of an elongated extended frame. The said base bars are parallel at their middle portions and converge upwardly toward their end portions. The top longitudinal bar is indicated at 3 and is connected with the bars 1 and 2 by the braces 4, 5 and 6, the latter three braces forming a triangle substantially at right angles with the longitudinal bars. The said triangular brace bars 4, 5 and 6 are located at intervals be-

tween the longitudinal bars 1, 2 and 3 throughout the entire length of the frame, except at the extreme ends thereof, where the brace bar 4 is omitted for the reasons hereinafter described. The propeller blades are extremely long and narrow in contradistinction to the ordinary length of blade, and revolve in great circles, thus agitating the atmosphere within their circles at less frequent intervals, as will be hereinafter more fully described. The propellers are composed of the blades 9-9, some of which are shown broken away and are indicated at 9'-9'. These blades are fastened to the hubs 8, from which extend downwardly the propeller shafts 7, each journaled in its respective sleeve 10 at the junction of the frame bars 3, 5 and 6. Across the frame bars 5 and 6 is the brace bar 11, having a sleeve 12 at its central portion, through which passes the lower end of its respective propeller shaft. To the lower extremity of each propeller shaft is fastened a bevel gear 12', which meshes with the bevel gear 13 on the shaft 14-14', which latter is journaled at its extreme ends in the sleeves 15-15 in the brace bars 16, which are located at the extreme ends of the frame, just above where the bars 4-4 are omitted, as hereinbefore referred to. Each alternate bevel gear 13 engages the opposite side of its meshing gear 12', thus giving to the shaft connected to the latter a reverse direction. The blades of these alternate shafts are also reversely inclined, so that the said reverse direction does not change the direction of propulsion. The circles described by the revolutions of the several shafts are side by side and do not overlap and thus the agitation of the air in any one circle is less liable to affect that in either of its adjacent circles than if the said blades were arranged to swing in overlapping circles, and further, the reverse direction given to each alternate propeller has a tendency to compensate for any uniformly directed currents which might be set up throughout the atmospheric medium surrounding the whole machine by virtue of the rotation of a plurality of propellers in the same direction. The shaft 14-14' may be disconnected at its middle portion so that the motor will revolve only a part thereof. The said mechanism for disconnecting the shaft is a longitudinally moving clutch operated by the lever 20, fulcrumed on the bar 21, attached

to the upper end of which is a cord 22, passing over a pulley 23 and down into the car 29, terminating in a handle 24. By pulling on the cord, the lever 20 will throw the clutch longitudinally of the shaft and disconnect the two sections thereof, so that the operation of one will not in any way affect the operation of the other. I have not illustrated in detail any particular form of clutch, as one of any suitable construction may be utilized.

Referring to that section of the shaft indicated at 14', the inner end is journaled in the sleeve 17 of the brace bar 18, and adjacent to said end is keyed the gear 27, meshing with the gear 26, operated by the engine 25. This arrangement of connecting up the shaft with the engine enables me to operate one section of the shaft in either direction, leaving the other section of the shaft idle.

Suspended to the middle of the frame is a car 29, attached to the top of which are curved runners 30, the rear extremities of which project for some distance behind the car. These runners are flanged at their top portions, which flanges are inclosed loosely by the guides 32—32 attached to the lower sides of the frame bars. The car 29 is heavy compared with the frame, and by virtue of the principle of gravitation assumes its lowermost position relative to the frame. When it is desired to swing the frame for the purpose of inclining the propeller blades, a shaft 33, which is rigid with the lower part of the frame, is pulled rearwardly, forcing the frame along the runners 30 until it assumes its desired position, when the lever 33 is fastened to the rack 34 by means of the locking device 35. The rudder 36 is journaled to rotate in the sleeve 37, the latter being secured to the car. The stem 38 of the rudder is bent to any desired position within the car to form a crank to enable the rotation of the same. The rudder may be located in any suitable position around the vertical axis of the car and normally lies in a vertical plane. When turned out of this plane, however, it comes under the influence of a downward current of air, induced by the rotation of the propeller located nearest the car, and thus turns the car, together with its attached frame, around on its vertical axis, in a direction determined by the direction of inclination of the blade 36 thereof. The rudder, thus arranged, acts as a single blade propeller, of which the car is the hub, and when any air is forced downwardly against the same, it will cause the car to revolve on its vertical axis according to the direction of inclination of the blade. A further means of steering is disclosed in detail in Figs. 4 and 5, in which figures a portion of the driving gear and motors have been removed, in

order to more clearly bring out the details of the steering mechanism. On the extreme ends of the frame are journaled the blades 40—40', which are fastened to shafts 41—41' respectively, the inner ends of which carry pulleys 42—42' respectively. The said shafts are journaled to oscillate in cross bars, one of which is indicated at 43 in Fig. 5, connecting the frame bars 5 and 6. Journaled in bearings attached to the top of the frame are the pulleys 45—45' and 46—46', and about the center of the frame is located a drum 50. When in operation, these blades 40—40' are oscillated to incline in opposite directions, and by virtue of each being located under a propeller, it comes under the influence of a downwardly directed current of air, and thus causes the frame to revolve on a vertical central axis. Around the pulleys 42—42', and over the pulleys 45—45' and 46—46', and around the drum 50, passes a cord or wire 44—45. To the lower end of the drum 50 is attached a flexible shaft 47, which extends down into the car, and has a lever 48 at its lower extremity. By swinging the lever 48, the drum 50 may be revolved through the medium of the flexible shaft 47, so that the pulley cord 44 will pass upwardly on the farther side of the pulley 42, over the pulley 45, around the upper part of the drum 50 and over the pulley 45', passing downwardly on the farther side of the pulley 42', under the same, and upwardly on the near side of the said pulley, over the pulley 46', around the lower part of the drum 50, over the pulley 46 and down on the near side of the pulley 42, terminating in the upwardly extending wire 44 on the farther side of the pulley 42. These propeller blades 40 and 40' may be used together with the rudder 36, or the latter may be eliminated entirely. It is obvious that the said blades, when inclined in reverse directions, will cause the frame to twist around until they are turned back into their normal vertical plane. The direction of the turning of the frame is determined by the direction of inclination of the said blades.

As hereinbefore mentioned, the blades 9—9 and 9'—9' of the several propellers are much longer and narrower than the blades of ordinary propellers, so that when revolved they generate great circles, by virtue of which the air agitated by one blade has time to recover from its disturbance before being agitated by the next blade, especially at the circumference of the circle where the blades are the widest. This feature enables me to utilize a maximum resistance of the air, thus increasing the efficiency of the propulsion means. The several propeller shafts are journaled at such a distance apart from one another that the circle generated by the blades of one is independent of and does not overlap the circles generated by the blades

of the adjacent ones. As the machine always travels in such a direction that these propellers will be abreast, or, in other words, the frame of the machine being transverse to the direction of propulsion, the atmospheric medium surrounding and agitated by any one propeller is not in the path of nor in any way extends into the medium agitated by any of the other propellers. As heretofore stated, the alternate propeller shafts are geared to revolve in a reverse direction and have their blades reversely inclined in order that their direction of propulsion will always be upward, like that of the other propellers. Having the blades of the alternate propellers revolving in reverse directions from the other propellers has a tendency to compensate for any general direction of the air surrounding the entire machine, due to the revolution of all the propellers in one direction, and further, should the atmospheric medium within the circle of one propeller, by virtue of the continuous rotation of the blades in one direction, cause the said medium to assume a moving action following the blades, the reverse motion in the medium of the adjacent propellers will have a tendency to retard the motions thus set up in the several atmospheric mediums within the several circles. It is not necessary, however, that I should have the alternate propellers revolving in opposite directions, for, if desired, all those on the one end may be revolved in one direction while those on the other end may be revolved in the opposite direction, and further, in the case of a large propeller being used in the center and smaller propellers on the end portions, the direction of revolution of the large one may be opposite to that of the smaller ones, or I may have the oppositely revolved propellers arranged in any other manner, provided that the revolutions balance each other, and are not such as to result in any turning effect upon the frame.

Having now described the construction of my device, I will proceed to explain the operation thereof.

Assuming that the car is resting on the ground and is supporting the frame in its normal position, as indicated in Figs. 1 and 2, I turn the rudder blade 36 into a vertical plane, and start all the propellers. The downward propulsion of the air will soon cause the machine to rise vertically until an arbitrary elevation is reached, when, by means of the depending rod 33, I swing the frame rearwardly on the runners 30 until the axes of the several propellers are inclined, as shown in Fig. 3. The propellers, thus swung to revolve in an oblique plane, cause the machine to travel in a horizontal direction, which direction is coincident with the resultant of the upward force of propulsion and the downward force of gravity, omit-

ting, of course, the other various factors, such as currents of air, etc., which surround a machine in the progress of its flight. When the angle of inclination of the axes is finally determined, the lever 33 is locked to the rack 34, attached to the car 29, by means of the locking device 35.

As heretofore stated, the rotation of the machine in a horizontal plane can be effected by turning the rudder 36 out of its vertical plane, bringing the same under the influence of one of the propellers, and thus the entire machine may be faced or directed toward any desired point. The raising and lowering of either end of the machine independently of the other may be effected by means of rotating the propellers on said ends either alone or simultaneously in opposite directions. To cause the machine to soar, aeroplanes may be attached in any suitable manner. In the form of my machine described herein, I have illustrated two aeroplanes 28—28, attached to the top bar 3, and to a pair of the bottom cross bars 4—4. These aeroplanes have no function whatever when the machine is ascending, but when the frame is inclined the aeroplanes are likewise inclined, and present an oblique surface against the forward motion of the machine, thus tending to raise the same or prevent it from descending.

The frame itself is built in skeleton form, having its brace bars composed of drawn steel tubing, or of aluminum, bamboo or other material which will have the necessary strength and at the same time the required lightness. Any form of motor may be used, minimum weight and maximum power being the desired elements. The car may be constructed in any suitable manner, and may be of basket form, cage-like or other configuration common in this art. If desired, an annular air cushion 39 may be fastened to the bottom of the car, for the purpose of avoiding any shock which might result in the machine's landing too abruptly.

Having thus described my invention, what I claim and desire to protect by Letters Patent of the United States is:

1. In a machine for navigating air, the combination with a normally horizontal propeller arranged above the frame of the machine, a rudder arranged in a normally vertical plane beneath said propeller and in the current of air delivered from said propeller, a car suspended beneath said frame, means to incline said rudder to turn said machine to the right or left under the action of said propeller, and means to incline said propeller from its normally horizontal plane to propel said machine substantially horizontally, by altering the angular relation between said frame and said car.

2. A flying machine comprising an elon-

- gated frame extending transversely of said machine, a series of propellers arranged longitudinally of said frame, a car suspended beneath said frame, a pair of blades for steering said machine journaled respectively in said frame and under the influence of said propellers and means to incline said propellers to propel said machine substantially horizontally by altering the angular relation between said frame and said car.
3. In a machine for navigating air, the combination with a rigid frame, of normally horizontal propellers arranged upon opposite ends of said frame, normally vertical blades journaled in said frame beneath said propellers, means to oscillate said blades simultaneously in opposite directions to turn said machine, and means for inclining said propellers from their normally horizontal planes to propel said machine substantially in a horizontal direction by altering the transverse angular elevation of said frame.
4. A machine for navigating air, comprising a transverse frame, normally horizontal propellers journaled to rotate adjacent to the ends thereof, normally vertical blades journaled to oscillate in said frame under the influence of said propellers, means whereby the blades may be simultaneously inclined in opposite directions and means to incline the axes of said propellers from their normally vertical plane and in a plane transverse to the longitudinal axis of said frame to propel said machine substantially in the direction in which the said axes of said propellers are inclined by altering the transverse angular elevation of said frame.
5. A machine for navigating air, comprising a transverse frame, horizontal propellers journaled to rotate adjacent to the ends thereof, normally vertical blades journaled to oscillate in said frame under the influence of said propellers, pulleys connected to said blades, a drum and connections between said drum and said pulleys whereby said blades may be simultaneously inclined in opposite directions by the rotation of the said drum.
6. A machine for navigating air, comprising a frame, a horizontal propeller carried by said frame, guides secured to said frame, a track supported in said guides, a car secured to said track and means for moving said frame along said track.
7. A machine for navigating air, comprising a frame, a horizontal propeller carried by said frame, guides secured to said frame, a curved track supported in said guides, a car secured to said track and means for moving said frame along said track.
8. A machine for navigating air, comprising a triangular frame, a horizontal propeller supported at one edge of said frame, guides secured to the two lower edges of said frame, a track supported by said guides, a car secured to said track and means for moving said frame along said track.
9. A machine for navigating air, comprising a frame, of triangular cross-section, an aeroplane and a propeller carried by said frame, guides secured to the two lower edges of said frame, a track supported by said guides, a car secured to said track and means for moving said frame along said track.
10. A machine for navigating air, comprising a frame of triangular cross-section, a horizontal propeller and a vertical aeroplane supported by said frame, guides carried by said frame from its two lower edges, a track supported by said guides, a car secured to said track and means for moving said frame along said track.
11. A machine for navigating air, comprising a frame triangular in cross section and extending transversely of said machine, a propeller mounted adjacent to the upper edge of said frame and carried thereby, a car supported by said frame from the two lower edges thereof and means for adjusting the angularity of said frame with respect to said car.
12. A machine for navigating air, comprising a triangular frame, a propeller supported by said frame adjacent to the upper edge thereof, guides secured to the two lower edges of said frame, a curved track slidably supported in said guides, a car rigidly secured to said track and means for moving said frame along said track.
13. A machine for navigating air, comprising a frame of triangular cross section, a propeller supported by said frame adjacent to the upper edge thereof, guides secured to the two lower edges of said frame, a curved track slidably supported in said guides, a car rigidly secured to said track and means for moving said frame along said track, said means comprising a lever rigidly secured to said frame and extending into said car and means for locking the lever in various positions with respect to said car.
14. A machine for navigating air, comprising an oblong frame triangular in cross section, a series of propellers with horizontally extending blades rotatably mounted upon said frame along the upper edge thereof, vertical shafts carrying said propellers and extending downwardly in said frame, bevel gears connected to the lower end of said shaft, a shaft extending longitudinally of said frame, bevel-gears upon said longitudinal shaft engaging with said gears of said vertical shafts, means for rotating said longitudinal shaft to drive said propellers, a car supported by said frame from the two lower edges thereof and means for adjusting the angularity of the said frame with respect to the said car.

15. A machine for navigating air, comprising an oblong frame extending transversely of said machine, horizontal propellers carried upon each side of said frame, a shaft extending longitudinally of said frame for rotating all of said propellers simultaneously, means for disconnecting said shaft centrally so as to throw out of operation the propellers upon one side of said machine, and means for adjusting the angularity of said frame with respect to said machine.

16. A machine for navigating air, comprising an extended rigid frame, a series of propellers journaled longitudinally thereof, the axes of said propellers being at such a distance apart that the circles described by their blades will not overlap, means for rotating one group of propellers independently of another group, a car suspended from the middle of said frame, and means for moving said frame to incline the axes of the propellers in a vertical plane.

17. A machine for navigating air, comprising an extended rigid frame, a series of propellers arranged longitudinally thereof, means for rotating said propellers, a car suspended from the middle of said frame, having curved runners rigid therewith, and means for moving said frame transversely to said car on said runners.

18. A machine for navigating air, comprising an extended rigid frame, a series of propellers arranged longitudinally thereof, means for rotating said propellers, a car suspended from the middle of said frame, means for moving the frame transversely to incline the axes of the propellers in a vertical plane, and normally vertical blades journaled to oscillate adjacent to the extremities of said frame and under the influence of the propellers.

19. In a flying machine, the combination with an elongated rigid frame, the longitudinal axis of which extends transversely to the direction of the flight of said machine, a series of propellers extending longitudinally of said frame and arranged normally in a horizontal plane above said frame, rudders beneath said propellers and

arranged normally in a vertical plane, means for simultaneously inclining said rudders in opposite directions, and means to incline said propellers from their normally horizontal plane and in substantially the direction of the flight of said machine by altering the transverse angular elevation of said frame.

20. In a machine for navigating air, the combination of a frame, a series of propellers mounted in said frame and arranged above said frame in a normally horizontal plane, means carried by said frame for actuating said propellers, a car suspended from said frame, means to move said car with respect to said car to incline said propellers with respect to said car to propel the said machine in a generally horizontal direction, and a rudder carried by said car and arranged normally in a vertical plane beneath a propeller to change the direction of the flight of said machine.

21. In a machine for navigating air, the combination of a frame, a series of propellers arranged longitudinally of said frame and normally in a horizontal plane above said frame, said propellers being arranged symmetrically with respect to the central vertical axis of said frame, means to rotate each propeller in a direction opposite to the direction of its adjacent propeller, a car suspended from said frame, means to move said frame with respect to said car to incline said propellers from their normally horizontal plane and in a direction of the flight of said machine transversely to the horizontal axis of said frame, steering blades located beneath said propellers and under the influence of the air delivered from said propellers and in a normally vertical plane, and means to incline said steering blades from their normally vertical position to turn said machine in its flight.

In witness whereof, I have hereunto set my hand this 25th day of April, A. D., 1906.

PRINCE C. HOPKINS.

Witnesses:

GEORGE F. NEWCOMB,
ARTHUR S. JAMESON.