W. H. KELLY.

FLYING MACHINE.

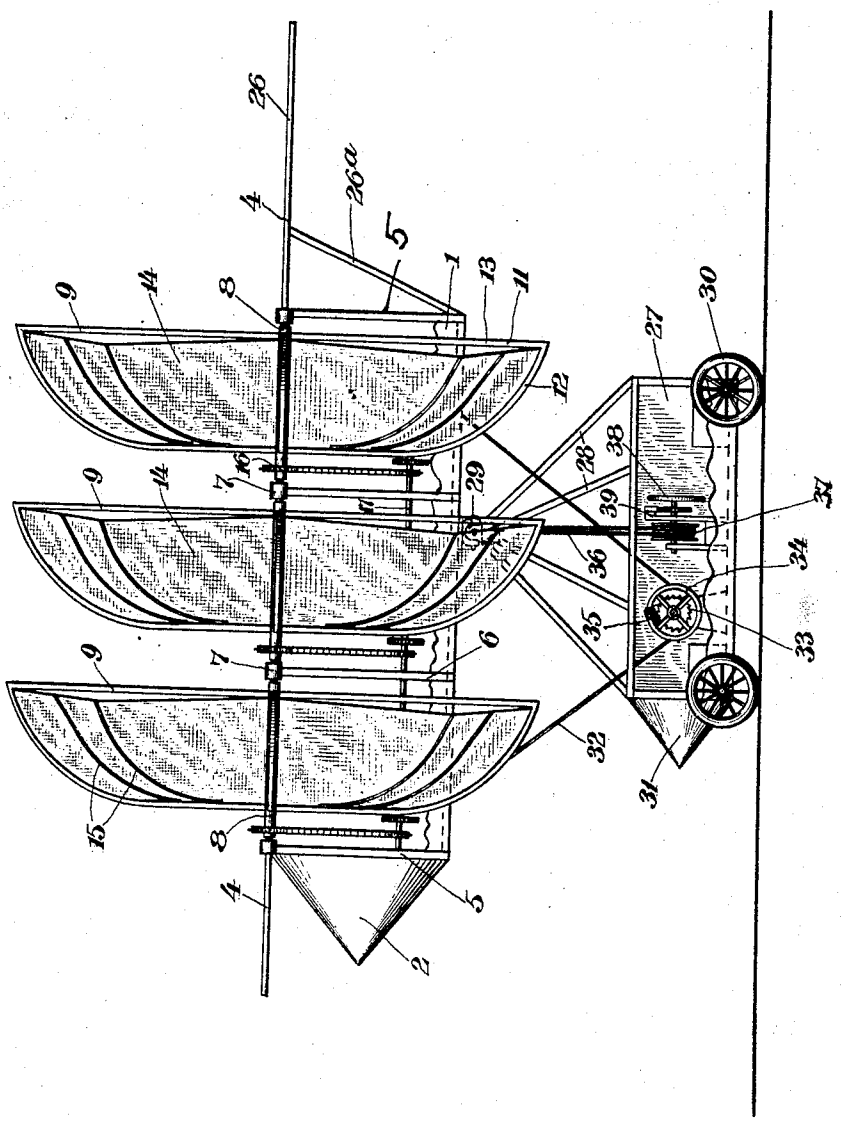
APPLICATION FILED JULY 17, 1909.

1,177,710.

Patented Apr. 4, 1916.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

Fig. 4

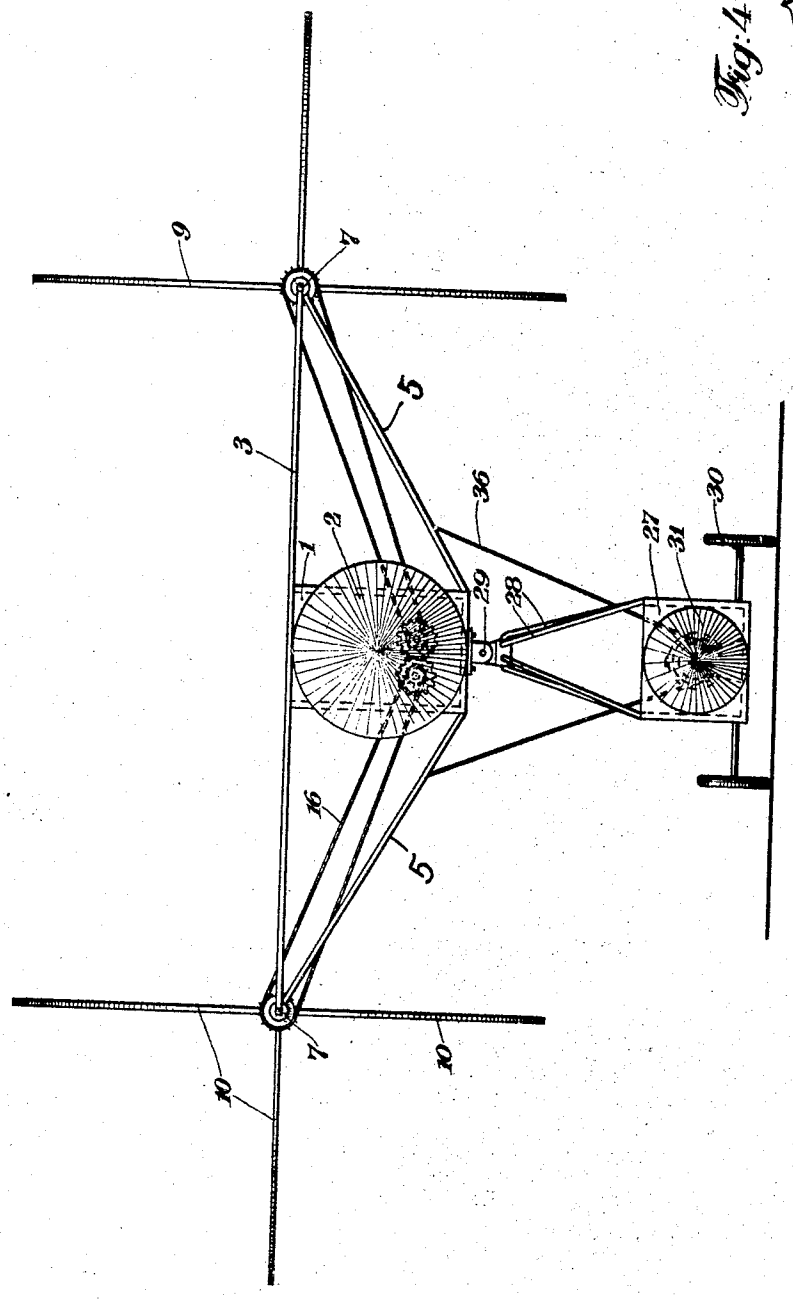

Fig. 2

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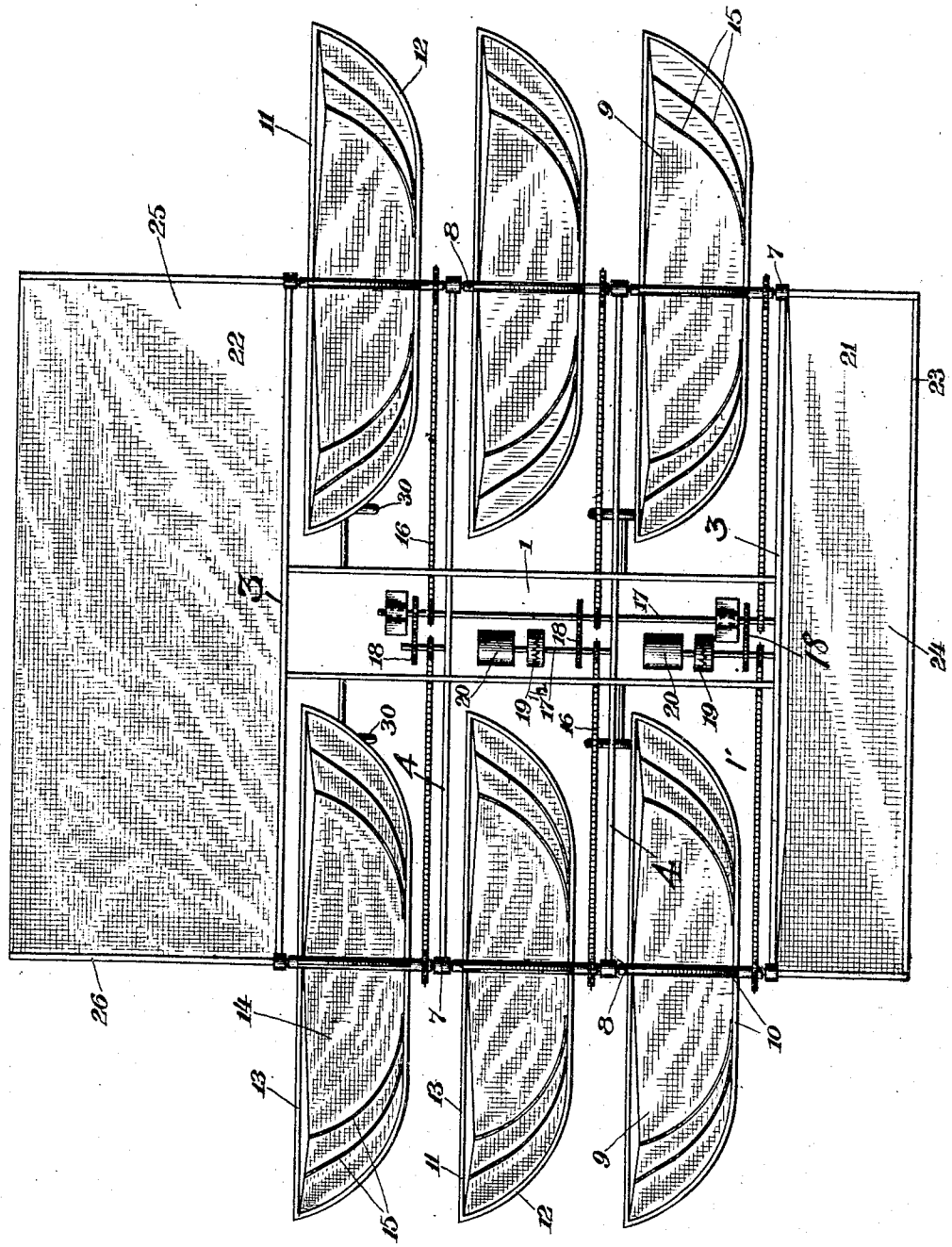
3 SHEETS—SHEET 3.

Fig. 3



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WILLIAM H. KELLY, OF CHEYENNE, WYOMING.

FLYING-MACHINE.

1,177,710. Specification of Letters Patent. Patented Apr. 4, 1916.

Application filed July 17, 1909. Serial No. 508,098.

To all whom it may concern:

Be it known that I, WILLIAM H. KELLY, of Cheyenne, in the county of Laramie, and in the State of Wyoming, have invented a certain new and useful Improvement in Flying-Machines, and do hereby declare that the following is a full, clear, and exact description thereof.

The object of my invention is to provide a flying machine which approximates very closely and embodies the essential features of natural flight. Although my flying machine is based upon the theory of natural flight, it is however, in many respects a great improvement over the same, as the principles thereof are carried further than they are in the case of any flying creature.

In general, my flying machine comprises a number of wings driven by suitable motive power, and having attached thereto a car for carrying the motors on substantially the same plane with the wings, and an additional car located beneath the first-mentioned car and pivotally supported therefrom.

One of the essential features of my invention relates to the construction of the several wings, as each wing approximates very closely the construction of the wing of a bird, and operates very similarly thereto. The wings which I use are constructed in such a manner that the front edges thereof are rigid, while the rear edges are flexible. They are, furthermore, rotated in a position in which the main body of each of the wings is located in a plane passing through the axis of rotation, while because of the flexibility of the rear edge of each of the wings, the said rear edge is moved into a position at an angle to the remainder of the wing. As a consequence, each wing operates substantially as an aeroplane, while at the same time all of the air is forced from in front of the same to the rear, and, therefore, enables the wing to operate as a propeller in a manner similar to the operation of a bird's wing. The wings can be moved into a position in which they rotate in a plane very nearly horizontal, to cause the apparatus to leave the ground, and they can then be moved into a position in which they rotate in a plane approximating the vertical, so that the propulsive power of the wings will be utilized to drive the machine forwardly, while at the same time the wings also act as aeroplanes to assist in sustaining the apparatus in the air. Because of this construction, the apparatus can be permitted to descend to the ground again very gently and without any danger of accident, by moving the plane of rotation of the wings into a position approaching the horizontal, and by decreasing their speed until the ground is reached. Provision is made, furthermore, for causing the apparatus to turn either to the right or the left or upwardly or downwardly, as desired, and also for maintaining the equilibrium of the apparatus both longitudinally and laterally.

I have shown one embodiment in the accompanying drawings, in which,

Figure 1 is a side elevation of the machine; Fig. 2 is an end-elevation of the same; Fig. 3 is a plan view thereof; and Fig. 4 is a detailed view of another form of wing.

In the drawings, 1 is a car provided with a pointed front end 2. Across the two ends of the car 1, and at the top thereof, there are located a pair of horizontal rods 3. Two other similar rods 4 pass across the top of the car, the rods 3 and 4 being located an equal distance from one another. Rods 5 and 6 are provided extending from the ends of the rods 3 and 4 to the bottom of the car 1, in order to brace the rods 3 and 4. Journals 7 are arranged in the ends of the rods 3, 4, 5 and 6 for supporting shafts 8. There are two of the shafts 8, one at each side of the car, and each of said shafts, as shown in the figures, is provided with three sets of wings 9. Each wheel or rotary member 9 comprises, as shown in the figures, four wings 10, but a smaller or greater number of wings may be used if desired. Each wing, as shown in Figs. 1 and 3, comprises a supporting frame 11 having a curved front rod 12 and a rear straight rod 13. A sheet of flexible fabric, such as canvas, 14 is fixedly attached to the front rod 12 and to the shafts 8. The rear edge of the sheet of canvas is not attached to any portion of the frame of the wing. In order to strengthen the fabric 14, a number of curved ribs 15 are provided, which extend from the inner portion of the front rod 12 outwardly and rearwardly to the rear edge of the flexible fabric 14. The shafts 8 are connected by means of sprocket chains 16 to shafts 17 and 17½, situated within the car 1.

As shown in Fig. 3, the three sets of wings on one side of the car are connected to a continuous shaft 17 in the car 1, which shaft is geared by means of gears 18 to a

series of alined shafts 17½, said series of alined shafts 17½ being connected to the shaft 8 on the other side of the car. The shafts 17½, which are connected to the shaft 8, last referred to, are connected by means of clutches 19 to suitable driving motors 20 of any desired type. It will thus be seen that by this construction all of the sets of wings are geared together and adapted to be driven by both motors 20 simultaneously, but that in case one of said motors becomes disabled the remaining motor 20 can still be utilized to drive all of the sets of wings.

The car 1 is provided at its front along the top edge, with a narrow stationary aeroplane 21, and at its rear with a wide stationary aeroplane 22. The aeroplane 21 is supported upon a frame 23, and comprises a sheet of fabric 24 of any desired material, such as canvas. The rear aeroplane 22 is also made of a sheet of canvas 25, and is supported upon side rods 26. Bracing rods 26ª extend from the side rods 26 to the bottom of the car 1. A car 27 is supported by means of a plurality of rods 28 upon a universal joint 29, located upon the bottom of the car 1. The car 27 is provided with four wheels 30 to support the apparatus upon the ground while in motion, and a pointed end 31. Means are provided for changing the angle of the car 27 to the rest of the apparatus. This comprises a cable 32 attached to the front and rear of the car 1 and extended around a drum 33 in the car 27. The drum 33 carries a handle 34 for winding or unwinding the cable. The drum 33 is also provided with a ratchet and pawl mechanism 35, so as to retain the drum in any given position. In a similar manner, a cable 36 is attached by means of its ends to the opposite sides of the car 1 to a pair of the rods 5, and the said cable is wound upon a drum 37 situated in the car 27, which drum carries an operating handle 38 and a ratchet and pawl mechanism 39.

The wings of the apparatus may be of any desired shape, provided the front edge thereof is rigid and the rear edge is either flexible or inclined at an angle to a plane at right angles to the direction of movement of the wing. As shown in Fig. 4, instead of providing the wing with a curved front edge, as shown in the other figures, said front edge may be straight and the rear edge of the wing may be curved. The connections of the two sets of wings located at the two sides of the apparatus are such as to rotate said two sets of wings in opposite directions.

In the operation of the device, operators or mechanicians are located in the car 1 and also in the car 27. When it is desired to cause the apparatus to leave the ground, the operating handle 34 is turned so as to move the shafts 8, carrying the sets of wings, into a position of considerable inclination. Upon the wings 13 being rotated, the same operate in a manner similar to the propelling blades of a helicopter, so as to cause the apparatus to be lifted from the ground. It is assumed that the inclination of the axis of the propeller blades and the car will not exceed 45 degrees from the horizontal so that it will be practicable for mechanicians to occupy this car. The latter may of course be made of special construction with this end in view. As the desired elevation is obtained, the shafts 8 are moved into a position approximating the horizontal by operating the handle 34. The wings 13 then operate to propel the car forwardly, and at the same time assist in sustaining the apparatus by assuming the functions of aeroplanes. It will be realized that a greater portion of the area of each of the wings is at all times located in a plane which passes through the axis of rotation, while at the same time the rear edge of each wing is moved to some extent out of said plane. These operations are closely analogous to the operations which take place in the flapping of a bird's wing. The front and rear stationary aeroplanes 21 and 22 assist in sustaining the apparatus in the air.

While the apparatus is sustained in the air, it may be driven either upwardly or downwardly, as desired, by changing the angle of inclination of the car 1 and the various planes thereon to the line of flight. Should it be desired to turn from right to left, or the reverse, the handle 38 can be operated so as to incline the car 1 and the various planes located thereon to the car 27. As a result of the mere inclination of these various planes, especially the planes 21 and 22, the apparatus will be caused to turn to one side or the other, as desired, according to the well-known principles of aerial-flight.

While flying, the equilibrium of the device is maintained by shifting the angle of the car 1 to the car 27, by the operation of the handles 34 and 38. Should the apparatus be tipped to the left by a gust of wind, the car 27 may be moved to the right so as to over-balance the apparatus in the other direction, and thereby bring the planes 21 and 22 to a horizontal position again. A similar adjustment can take place in case either the front or rear of the machine is moved upwardly by the air currents. The additional width of the rear aeroplane 22 assists in maintaining the longitudinal equilibrium of the apparatus, in a manner the tail of a bird. The low center of gravity of the entire apparatus will also tend vity of the entire apparatus will also tend materially toward the maintenance of the apparatus in any position which has been assumed by it for flying. The location of a

large portion of the weight in the lower car 27, and also another large proportion of the weight at a point above the car 27 in the car 1, will also tend materially to the maintenance of the apparatus in any given position, as with the weight thus distributed at two separate points and while traveling at a considerable speed, it will take an unusually great force to cause a rotation of the entire mechanism in either a transverse or a longitudinal plane.

In order to cause the apparatus to alight, the handle 34 is operated so as to move the shafts 8 into a position approximating the vertical whereupon the speed of the apparatus will be gradually lessened, and by lessening the speed of the wings 13, the apparatus can be gradually brought to the earth. The stopping of the apparatus will be greatly facilitated by stationary planes 21 and 22, and the safety of the landing will be much increased by the provision of the wide rear stationary plane 22. The safety of the landing follows from the fact that, as the center of gravity of the apparatus is extremely low, and as the retarding effect will be produced by the planes which are located above it, there would be a marked tendency, in the absence of a provision of the wide rear stationary plane 22, for the upper part of the apparatus to be slowed down more rapidly than the lower part. As a result, there would be a tendency for the lower car 27 to run in advance of the upper car 1, thereby overturning the apparatus, were it not, as stated, for the provision of the wide rear plane 22. The provision of said plane 22, however, in such a position that when the shafts 8 are in position approaching the vertical, the said plane 22 is situated immediately in the rear of the car 27, will prevent the car 27 from moving in advance of the car 1. Consequently, the car 1 and the car 27 are slowed down with equal rapidity, and the apparatus brought to a stop without danger of overturning.

As illustrated in the drawing, the rear free edge of each wing is slightly inclined rearwardly from a point intermediate its extremities. This construction is advantageous for the reason that it will tend to cause the air to flow inwardly, thus counteracting the other tendency of the air to be fanned outwardly, the resultant of these two tendencies being a flow of the air directly rearward and parallel to the axis of the shaft.

While I have described my invention above in detail, I wish it to be understood that I consider my invention to be a broad one and capable of many changes and adaptations without departing from the spirit thereof.

I claim:

1. In a flying-machine, the combination with a suitable framework, of a shaft mounted to rotate in said framework and having its axis parallel with the direction of flight, and a wing connected with said shaft, extending radially therefrom, the said wing having a rigid forward edge, its body portion being flexible and normally lying in a single plane, passing longitudinally through the axis of the shaft, the rear edge of the wing being free.

2. In a flying-machine, the combination with a suitable frame, of a shaft journaled in said frame, its axis extending parallel with the direction of flight, and a wing connected with said shaft and extending radially therefrom, the forward edge of said wing being rigid and its outer portion being curved rearwardly, its body portion being flexible and normally lying entirely in a plane passing longitudinally through the axis of the shaft.

3. In a flying-machine, the combination with a suitable frame, of a shaft journaled therein and having its axis extending in the direction of flight, and a wing connected with said shaft and extending radially therefrom, the forward edge of the wing being rigid and its outer portion rearwardly curved, a rod extending from the outer extremity of the rigid forward edge of the wing to the shaft, the body of the wing being flexible and normally lying in a single plane parallel with the axis of the shaft, its rear edge being free between the shaft and the outer extremity of its rigid forward edge.

4. In a flying-machine, the combination with a frame, of a shaft journaled therein and having its axis extending in the direction of flight, and a wing connected with the shaft extending radially therefrom and normally lying in a single plane parallel with the shaft's axis, the forward edge of the wing being rigid and having its outer portion rearwardly curved, the body of the wing in the rear of its rigid forward edge being flexible, and its rear edge being free between the shaft and the outer extremity of its rigid edge, the body of the wing having strengthening ribs curved rearwardly from the rigid forward edge to the flexible rear edge of the wing, substantially as described.

5. In a flying-machine, the combination with a suitable frame, of a shaft journaled in said frame and having its axis extending in the direction of flight, and a wing connected with the shaft at its inner extremity and extending radially therefrom, the forward and outer edge of the wing being rigid and the outer portion of the rigid edge of the wing extending rearwardly, terminating at the rear outer corner of the body of the wing, a rod extending from said corner inwardly to the shaft, forming the

framework of the wing, the body of the wing being flexible and secured to the shaft and to the rigid forward and outer edge of the wing, the rear edge of the wing between its outer rear corner and the shaft being free, the body of the wing in the rear of its rigid front edge normally lying in a single plane parallel with the shaft's axis, substantially as described.

6. In a flying-machine, the combination with a framework, of a shaft journaled in said framework, its axis extending in line with the direction of travel, and a wing connected with the shaft and extending radially therefrom, the forward edge of the wing being rigid and its outer portion being rearwardly curved and terminating at the outer rear corner of the wing, a rod extending from said corner to the shaft and connected with the latter, the body of the wing being flexible and surrounded by the rigid forward edge in front, the rod in the rear and the shaft at its inner end, the said body portion of the wing normally lying in a single plane and its rear edge being free, the plane of the wing being parallel with the axis of the shaft.

7. In a flying-machine, the combination of a shaft, a framework in which the shaft is journaled, a wing extending radially from the shaft and having a frame comprising a forward rigid edge, its outer portion extending rearwardly and terminating at the outer rear corner of the wing, the body of the wing being flexible and normally lying in a single plane parallel with the axis of the shaft, the said flexible portion of the wing being secured at its inner end to the shaft and at its forward edge to the rigid forward portion of the wing, its rear edge being free between the outer rear corner of the wing and the shaft, substantially as described.

8. A flying-machine, comprising a frame, a shaft journaled therein and whose axis is arranged in line with the direction of flight, a plurality of wings extending radially from said shaft, each wing having a rigid forward edge, its outer portion extending rearwardly and terminating at the outer rear corner of the wing, the body portion of each wing being flexible and having its inner end and its forward edge between the shaft and the outer rear corner of the wing secured to the said rigid edge, the rear edge of the flexible part of each wing between the outer rear corner and the shaft being free to be fixed in response to the resistance of the atmosphere, the flexible part of the device normally lying in a single plane parallel with the shaft's axis, substantially as described.

9. In a flying-machine, the combination with a suitable frame, of a shaft journaled therein and whose axis is parallel with the direction of flight, and a wing connected to the said shaft, radially arranged thereon and having a rigid forward edge lying between parallel planes which are parallel with the axis of the shaft, the body portion of the wing in the rear of its front edge having the entire length of its edge contiguous to the rigid forward edge, connected with the latter in a plane parallel with the axis of the shaft, the said body portion of the wing in the rear of its front edge, when the wing is in operation, being flexed out of the last-named plane, gradually, as it extends rearwardly to its rear edge, which has the greatest degree of flexure, the rear edge of the wing allowing the air to escape freely therefrom, the surface of the wing in a line connecting any two points in its front and rear edges, equally distant from its axis, normally lying in a plane passing longitudinally through the axis of the wing and the said points.

10. In a flying machine, the combination with a suitable frame, of a shaft journaled therein and a wing attached to said shaft, said wing having a rigid forward edge which extends to its outer extremity and having flexible ribs connected with said forward edge and extending rearwardly therefrom, the said wing including flexible fabric which is attached to its rigid forward edge and also to the flexible ribs, the outer portion of the flexible body of the wing which is nearest to the outer extremity thereof, considered with reference to its distance from the axis, being only slightly flexible and increasing in flexibility as it extends toward the axis, the surface of the wing in a line connecting any two points in its front and rear edges, equally distant from its axis, normally lying in a plane passing longitudinally through the axis of the wing and the said points.

11. In a flying machine the combination with a suitable frame work, of a shaft mounted to rotate in said frame work and having its axis parallel with the direction of flight, and a wing connected with said shaft and extending radially therefrom, the body of the wing being flexible and having a rigid frame extending entirely around the same except in the rear.

In testimony that I claim the foregoing I have hereunto set my hand.

WILLIAM H. KELLY.

Witnesses:
G. B. PRINDLE.
A. NEWCOMB.