J. E. HARRIMAN, Jr.

FLYING MACHINE.

APPLICATION FILED FEB. 8, 1904.

972,448. Patented Oct. 11, 1910.

4 SHEETS—SHEET 1.

Fig. 1.

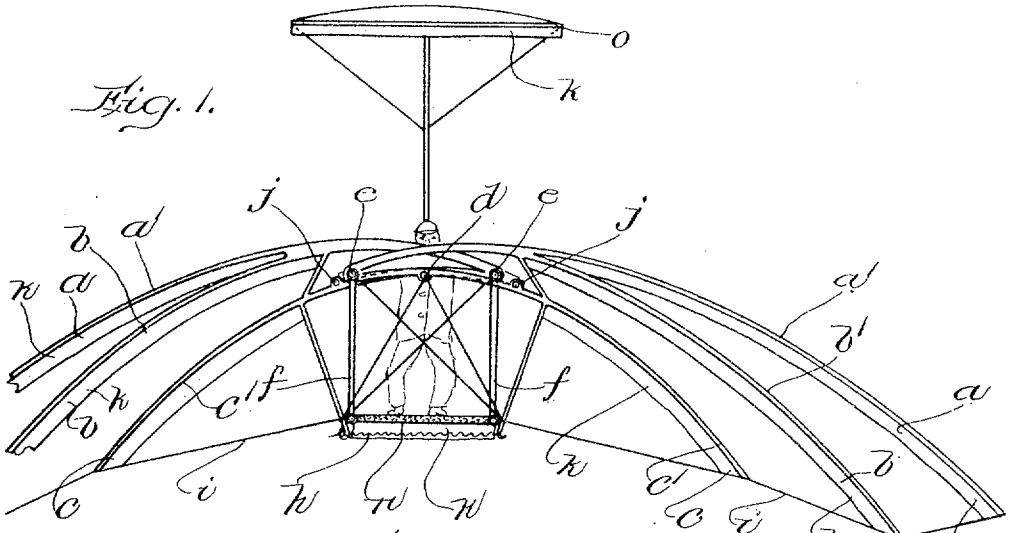


Fig. 2.

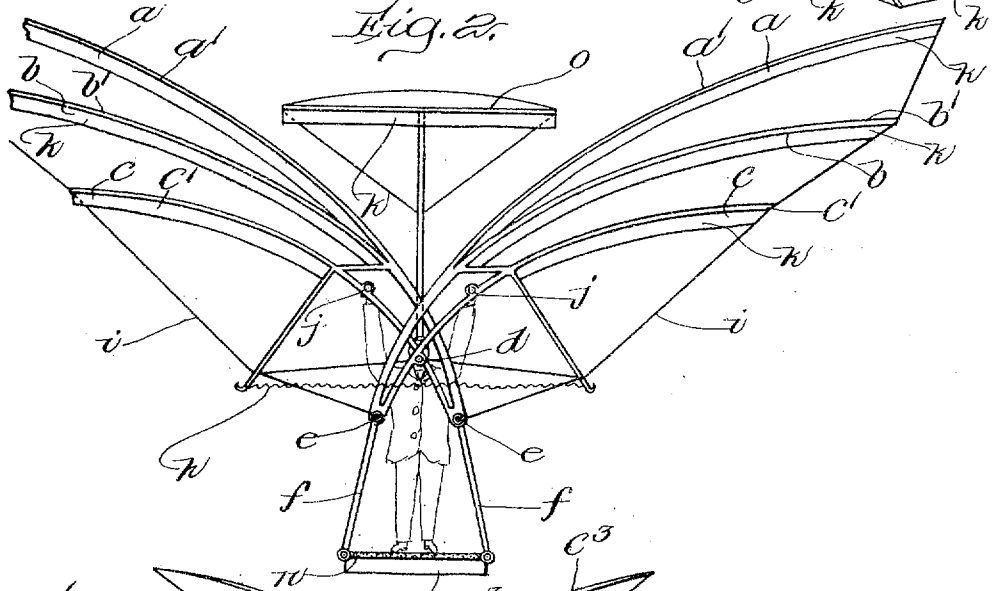
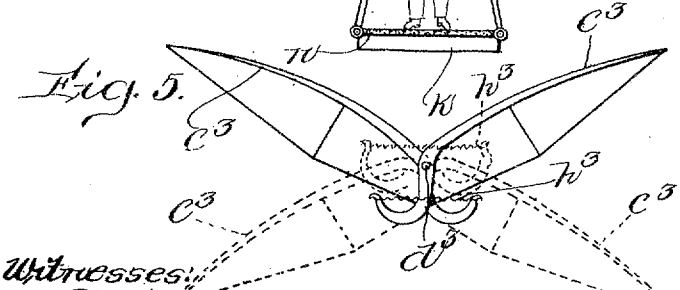


Fig. 5.



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4 SHEETS—SHEET 2.

Fig. 3.

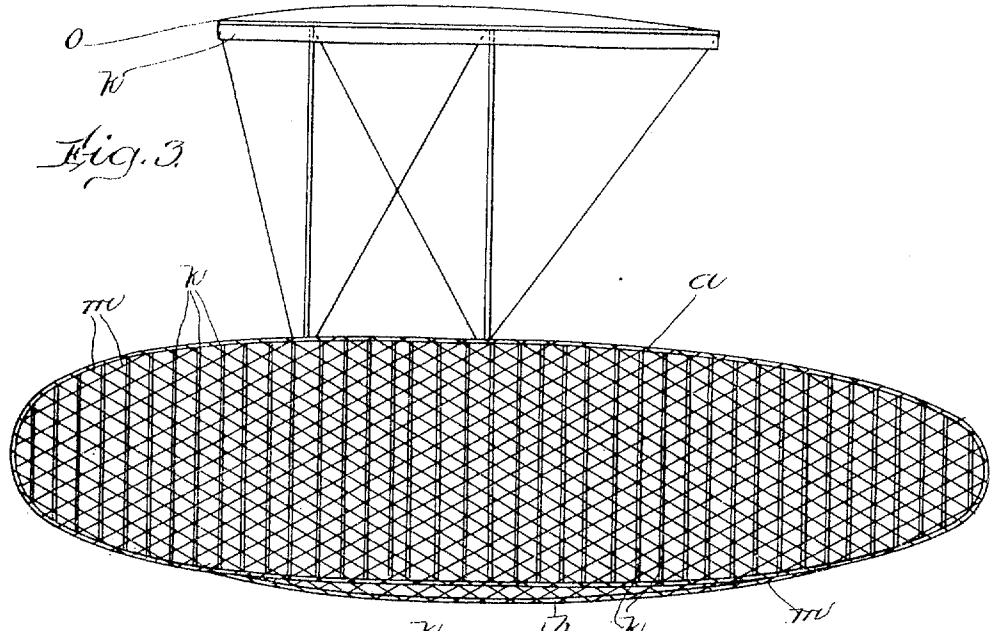
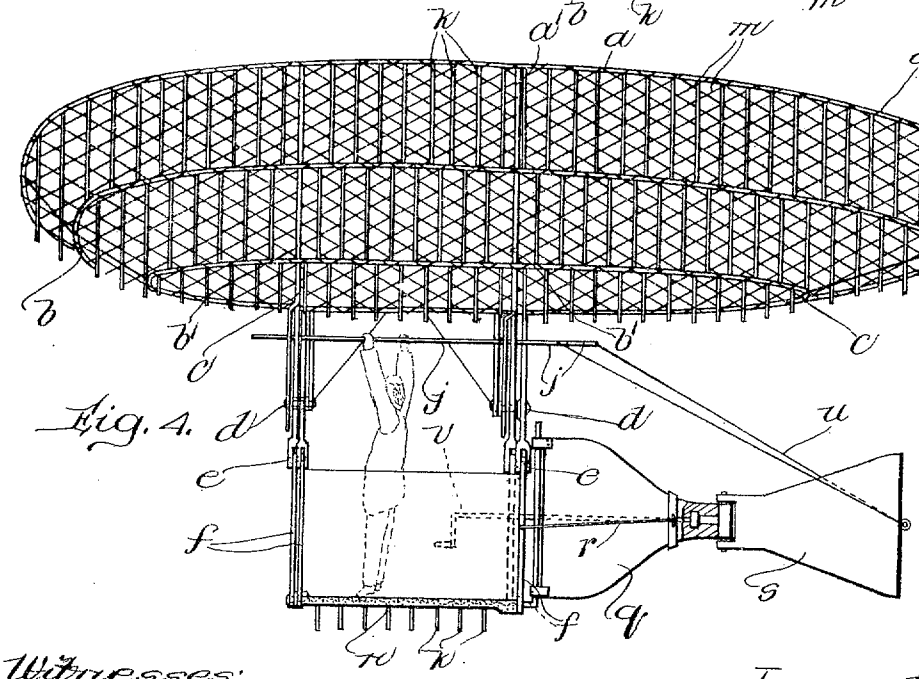


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 6.

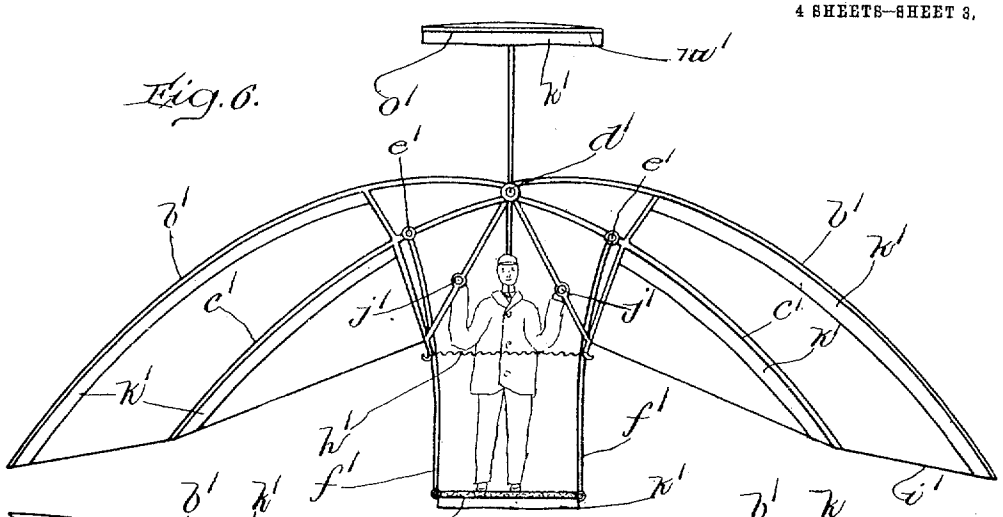


Fig. 7.

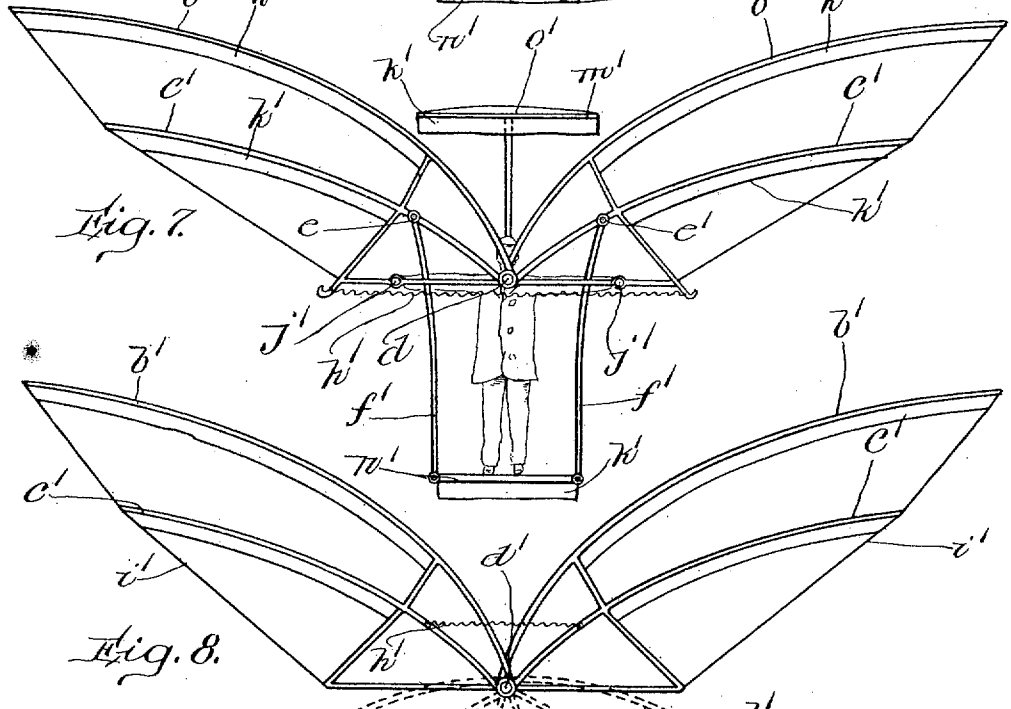
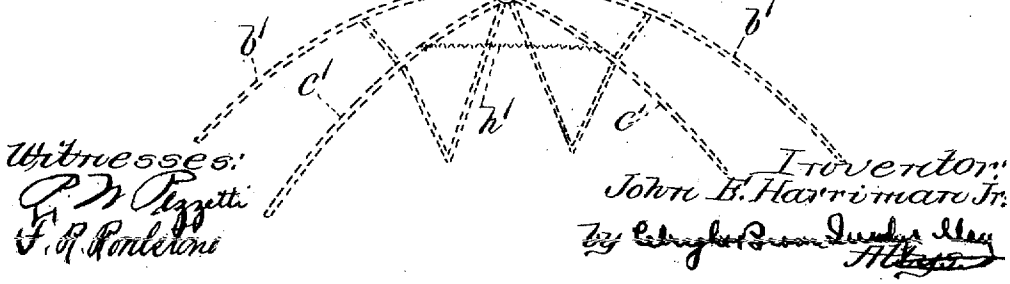


Fig. 8.



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4 SHEETS—SHEET 4.

Fig. 9.

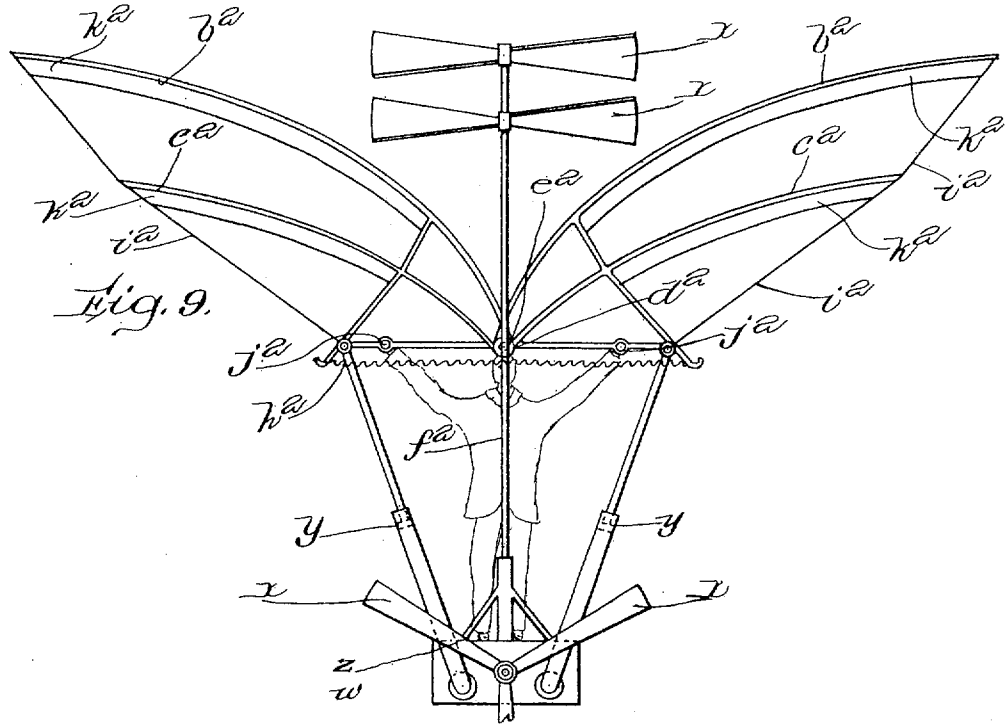
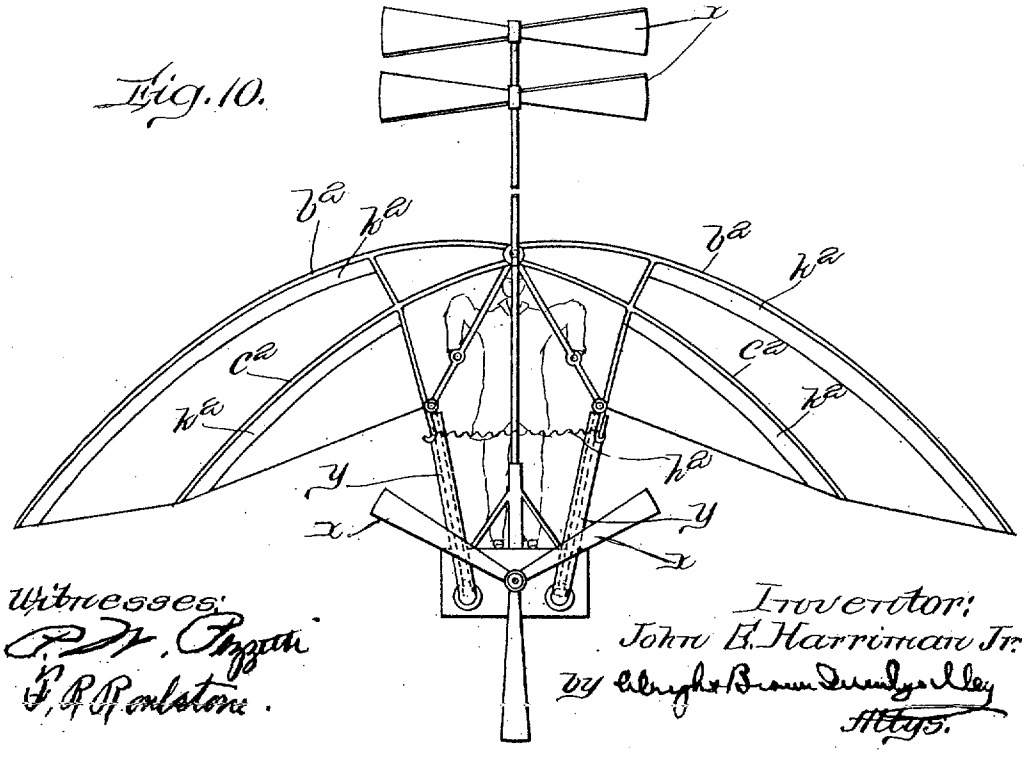


Fig. 10.



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UNITED STATES PATENT OFFICE.

JOHN EMERY HARRIMAN, JR., OF BROOKLINE, MASSACHUSETTS.

FLYING-MACHINE.

972,448. Specification of Letters Patent. **Patented Oct. 11, 1910.**

Application filed February 8, 1904. Serial No. 192,484.

To all whom it may concern:

Be it known that I, JOHN EMERY HARRIMAN, Jr., a citizen of the United States, and a resident of Brookline, in the county of Norfolk and State of Massachusetts, have invented an Improvement in Flying-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to flying machines and particularly to machines of this class in which wings or supporting planes, and in some cases balloon constructions, serve to afford buoyancy to the mechanism, and in which motive power may be applied either by spring or other tension device, muscular effort of the operator, or by any suitable mechanical motor attachment.

In the particular embodiment of the invention herein selected for illustration the device comprises chiefly a plurality of wings or surrounding planes pivoted at or near their inner ends, together with a support or car for the operator, located substantially centrally of the wings or supporting planes. For convenience in description the term "wings" will be employed to indicate the buoyant element. In the preferred construction of the invention these wings are pivoted together both at the front and the rear of the device on a median or central longitudinal line, the inner ends of the wings projecting slightly beyond the pivot points, and the car or operator's support in this case is preferably suspended from the overlapping inner extremity of said wing and at any practical distance from the median pivot line.

In the drawings, Figure 1, illustrates the preferred form of the invention in front elevation with the wings in collapsed position: Fig. 2, shows the device in front elevation with the wings in open or raised position; Figs. 3 and 4, are side elevations of the construction in the positions shown in Figs. 1 and 2, respectively; Fig. 5, illustrates a modified form of spring connection for the wings; Figs. 6 and 7, illustrate a modified form of the construction in collapsed and open positions, respectively; Fig. 8, illustrates still another modified form of spring connection between the wings; Figs. 9 and 10 show a third modification in open and closed positions, respectively, of the complete device and method of applying motive power.

In the preferred form of the invention illustrated in Figs. 1 to 4, inclusive, the wings or buoyant elements are composed of a plurality of planes *a*, *b* and *c*, suitably secured together at their inner ends and having their outer extremities subtended by a truss chord *i* which extends from the outer extremity of the outermost wing to the inner extremity *e* thereof. The wings or buoyant elements are in this construction pivoted at the front and rear by the connecting bolts *d*, Fig. 4, which are located as shown, a short distance from the inner extremities of the wings. A support or operator's car *n* is supported by any suitable means as the rods *f*, *f* from the inner extremities of the wings, preferably with the right side of the car attached to the inner extremity of the left wing and the left side of the car to the inner extremity of the right wing, said rods being hinged to the car and wings respectively. At a convenient distance from the pivot point of the wings are located the operating or guide rods *j* which are attached preferably to the supporting frame of the inner planes *c* and are capable of forward and back sliding movement in their supports for a purpose hereinafter described. The areas of the planes of the supporting wings or buoyant members may be intersected and the wings braced by a plurality of cords or rods *m* attached to the outer periphery of the frames of the wings and arranged in any desired and convenient manner as, for example, to form a network, as shown in Fig. 4. Beneath this network is suspended a series of parallel flaps *k* of any suitable and it may be flexible material, the flaps extending in this case transversely of the wings and being attached at their upper edges to the frames and if desired, also to the network *m* at intervals. It is obvious that these flaps may be continuous from end to end or may be divided into sections of greater or less length. These flaps are preferably located apart a distance equal substantially to their own width or depth and are constructed to swing freely from a position at right angles to the plane of the wing to a position flat against the network within the plane of the wing. A central canopy or parachute of any desired form or construction as *o* may be supported above

the longitudinal median line of the wings and held in position in any desired manner. This canopy, also, may be provided with a network similar to that of the wings and with the flaps *k*. A powerful spring *h* may be connected with the opposite wings at convenient points some distance from, and preferably below, the pivot line *d* thereof, whereby the spring will normally exert a power to draw the wings to collapsed position, as shown in Figs. 1 and 3. A suitable steering apparatus such as a wing *q* to the outer extremity of which is pivoted a rudder *s* may be attached in any desired manner to the rear of the mechanism and may be strengthened in its position by braces *r* extending from the outer extremity of the stationary portion of the guide wing to the supports *f* for the car. Steering lines *u* may be extended from a suitable frame attached to the rudder *s* to the operating or guide rods *j* whereby the movements of the steering apparatus or rudder may be controlled by the operator. As shown in Fig. 4 the pivot pin of the rudder *s* is connected to a rod rotatably mounted on the stationary part *q*, said rod having a crank handle *v* at the forward end thereof. By this construction the rudder may be turned into either a vertical or a horizontal plane to effect lateral or vertical steering respectively of the apparatus. When in either of these positions the steering lines or rods *u* connected with the operating rods *j* will be in position to effect the deflections of the rudder for steering purposes. The framework of the device is constructed of extremely light and strong material, preferably aluminum, and all parts of the structure are reduced to the minimum size and mass consistent with the required degree of strength.

The operation of the machine is as follows: With the mechanism suitably supported at the upper end of an incline having an angle of inclination sufficient to permit of the device acquiring the necessary speed and with the wings supported in open position upon suitable supports beneath the outer extremities thereof the operator takes a standing position upon the car or support *n* and grasps the rods *j*, *j*. In this condition of the mechanism the weight of the operator and the weight of the car have a tendency to hold the wings in their distended and open position, as will be evident from an inspection of Figs. 1 and 2. The operator then springs from the floor of the car thereby transferring more or less of his weight to the rods *j*, *j*, whereupon this weight, augmented by the tendency of the spring *h*, tends to depress the wings. Simultaneously with the beginning of the downward movement of the wings, the flaps *k* are forced by the air pressure beneath the wings against the network *m* thereby converting the open wings of planes *a*, *b* and *c* into closed air resisting planes whereby a strong pressure is produced tending to resist the downward movement of the wings. In this condition of affairs the car having been relieved of the weight of the operator, the collapsing tendency of the spring *h* acting contrary to the upward pressure of the air upon the under sides of the wings has a tendency to force the central portion of the wings, together with the car, upward until the parts are in the relative position shown in Fig. 1. It is possible that the upward movement of the car at the upward spring of the operator may be so rapid that the feet of the operator will remain at all times in contact with the floor of the car. At this point the operator can retransfer his entire weight to the floor of the car, thereby tending to depress the same, together with the inner sides of the wings *a*, *b* and *c*. The air pressure, however, under the wings tending to resist their downward movement being very much greater than that on the car, due to the difference in their area, results in the wings as a whole remaining at the altitude reached while the car drops a short distance. The drop of the car under these conditions, however, will be considerably less than the distance to which it was raised upon the first operation of the machine for the reason that the muscular efforts of the operator and weights of the car and operator hasten the opening of the wings. By repeating the above described movements the device may be caused to rise from the ground or other support and after a sufficient altitude has been reached the operator may, by shifting his position from the front to the rear of the car and vice versa, further direct the upward and downward gliding movements of the apparatus, lateral movement thereof being controlled by the operator moving from right to left or vice versa and by shifting the rudder *s* through the instrumentality of the rods *j* and connecting lines *u*.

In the modification illustrated in Figs. 6 and 7 it will be noticed that the wings *b'*, *c'* are pivoted together at their inner extremities upon the longitudinal median line *d'* and that the car *n'* is supported at the points *e'*, *e'* of the wings, the car being supported on either side from the wings extending from the corresponding sides, respectively, of the pivot or median line *d'*. The operating rods *j'*, *j'* are attached to the frames of the corresponding wings, respectively, and a spring *h'* is suitably connected with the opposite wings to exert a collapsing force thereupon. The operation of this form of device differs slightly from that heretofore described for the structure illustrated in Figs. 1 to 4. The mechanism, as before stated, is supported upon a suitable elevation or at the head of an incline from which the

start may be made and the initial velocity obtained. With the mechanism in the position illustrated in Fig. 6, at the start the first tendency of the device is to drop by gravity, the weight of the operator and of the heavier portions, such as the car, being located in line with the pivot rod d', the tendency is for this portion of the machine to follow more rapidly. This tendency is augmented by the fact that the mechanism is open along the median line, therefore offering little resistance to the air. The outer extremities of the wings, on the contrary, present a wide area of resistance to the air when the machine is falling, which resistance is sufficient to permit the central portion of the mechanism to drop with comparative rapidity, while the outer extremities of the wings remain relatively almost stationary. This combination of forces results in extending the wings or in permitting the car and operator to drop to the position illustrated in Fig. 7. It is to be understood that the air resisting flaps h' during these operations are held firmly against the corresponding net m of the wings, especially at the outer extremities thereof; whereas at those portions of the wings nearer the center, the flaps remain open more or less, thereby augmenting the tendency to relatively hasten the downward movement of the car and operator. This tendency is, however, to some degree checked by the canopy o', which is supported some distance above the pivot point d'. It is obvious from an inspection of Fig. 6 that the weight of the car and operator, together with the spring h, tend to hold the wings in collapsed position but for the fact that this weight is sustained on the wings near the center of the machine and therefore the wings are caused to open by the air pressure beneath the outer extremities thereof, as above described, this movement being assisted by lateral outward and upward pressure by the operator upon the rods j', j' in a line substantially parallel with the direction of tension of spring h'. In order to give an upward tendency to the car the operator springs lightly from the floor thereof, thus temporarily relieving his entire weight from the center of the device, whereupon the spring h' will exert a tension to draw the wings once more into collapsed position, this movement being also assisted by the movements of the operator in drawing his arms together, thereby causing the rods j', j' to approach. Inasmuch, however, as such downward movement of the wings would be powerfully resisted by the pressure of air beneath the same, the outer extremities of the wings remain comparatively stationary while the car and certain portions of the device rise relatively thereto.

Figs. 9 and 10 illustrate a third modification of the construction which operates on still a different principle. The parts of this device corresponding to similar parts of the forms first described are designated by letters a^2, b^2, etc. In this form of mechanism, however, the car or body is supported from the central pivot point or line d^2 by the supporting rods f^2 and is provided with a tension spring h^2 tending to draw together the opposite wings. The method of operation of this form of structure is substantially the same as that described for the form shown in Figs. 1 to 4. Suitable motive power may, if desired, be applied to the mechanism herein described. A form of motor is indicated by the parts w, x, y and z, the portions thereof y being arranged to assist in the opening and closing of the wings, while suitably arranged propellers may be operated to assist in imparting a forward and backward motion to the mechanism or to aid in its ascent. It is to be understood, moreover, that the buoyancy of the mechanism may be further augmented by any preferred form of dirigible balloon, which may be substituted for the canopy o or o^2.

The detail views Figs. 5 and 8, respectively, are intended to illustrate a different arrangement of the tension device h^3 corresponding to the springs h, h' and h^2 heretofore described. In the construction shown in Fig. 5, the wings or buoyant elements c^3 are pivoted at d^3 and are provided with extensions at their inner ends to which the tension device h^3 is attached. By forcing the central portion of this tension device h^3 either above or below the pivot point d a force will be exerted oppositely, either to close or open the wings, as will be obvious from an inspection of this figure. The operation of the parts in Fig. 8 is similar to that shown in Fig. 5 except that the operation of the spring is the reverse, that is to say, when the spring is above the pivot point there is a tendency to distend the wings; when below, to collapse the same.

Still another modification of applicant's construction may be effected by inclosing the frames of the wings by material impervious to gas, which material will also inclose the truss chords i, thus converting the wings or buoyant elements into forms of flat balloons connected together in all respects similar to the form shown in Figs. 1 to 4 inclusive. It is understood that in this form of the device the remaining elements, that is to say, the car n and the tension mechanism h may remain the same. In the operation of this form of the mechanism the functions of the operator are similar to those described in connection with Figs. 1 to 4, but in this case in addition to the resistance exerted by the areas of the wing-shaped balloons, the efforts of the operator are augmented by the buoyant character of the wings, whereby the

wings normally have a tendency to rise and the force exerted by the upward spring of the operator, and also by the tension device *h*, is entirely consumed in elevating the central portions of the wings together with the car. This construction has the advantage over mechanism in which the balloons or buoyant elements are rigidly connected for the reason that the force which it is possible for the operator to exert to assist the ascent of the device reduces to a minimum the buoyant capacity required by the balloon elements.

It will be obvious that many changes may be made in the construction and relative arrangement of parts without departing from the spirit and scope of this invention.

I claim:

1. In a flying machine, a plurality of wings composed of superposed aeroplanes secured together at their inner and outer extremities, said wings being pivoted together and a support for an operator suspended therefrom, means adapted to be grasped by the operator to collapse said wings, steering apparatus, and operating connections between said collapsing means and said apparatus whereby the device may be simultaneously operated and steered by the operator.

2. In a flying machine, a plurality of wings composed of rigidly connected superposed aeroplanes, a support for an operator suspended from said wings, means whereby the weight of the operator may be shifted from the support to the wings and vice versa to collapse and distend the wings respectively, steering apparatus, and operating connections between said collapsing means and said apparatus whereby the device may be simultaneously operated and steered by the operator.

3. In a flying machine, a plurality of wings composed of rigidly connected superposed aeroplanes pivoted together adjacent to their inner extremities, a support or car for an operator suspended from the inner extremities of said wings, means adapted to be grasped by the operator to collapse said wings, steering apparatus, operating connections between said collapsing means and apparatus, and tension means extending from wing to wing tending normally to collapse the same.

4. In a flying machine a plurality of wings the frames of which cross each other near their inner extremities, means whereby the wings are pivoted at the point of crossing, a support for an operator suspended from the inner extremities of the wings, hand bars slidably secured to the wings and adapted to be grasped by the operator to operate the mechanism, and means also operated by said rods to control the direction of flight.

5. In a flying machine a plurality of wings, the frames of said wings crossing each other near their inner extremities and pivoted together, a support for an operator suspended from the inner extremities of the wings, hand bars slidably secured to the wings and adapted to be grasped by the operator to operate the wings, and a rudder connected with and adapted to be operated by said hand bars.

6. In a flying machine a plurality of wings composed of a plurality of superposed buoyant elements, said wings being pivoted together near their inner extremities, an operator's car suspended from the inner extremities of said wings, longitudinally slidable operating hand rods extending forward and aft of said wings and attached outside of the pivot points, a vertical guiding plane at the rear of said machine having a rudder attached thereto and connection between said rods and rudder whereby the direction of flight may be controlled.

7. In a flying machine a plurality of wings pivoted together near their inner extremities, an operator's car suspended from the inner extremities of said wings, hand operated rods attached to the wings outside of their pivot points and a parachute attached to and located above said pivot points.

8. In a flying machine, a plurality of wings composed of aeroplanes, a support for an operator suspended from said wings, means whereby the weight of the operator may be shifted from the support to the wings and vice versa to collapse and distend the wings respectively, and an auxiliary motor mounted on said support and operatively connected with said wings to collapse and distend the same, and one or more propellers constructed and arranged to be operated simultaneously with or independently of the operation of said wings by said motor.

9. In a flying machine, a plurality of wings composed of aeroplanes, a support for an operator suspended from said wings, means whereby the weight of the operator may be shifted from the support to the wings and vice versa to collapse and distend the wings respectively, and an auxiliary motor mounted on said support and operatively connected with said wings to collapse and distend the same, one or more propellers mounted upon said support and arranged to be operated from said motor independently of or in conjunction with the operation of said wings by said motor or operator.

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

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