(Model.) 5 Sheets—Sheet 1.

R. J. SPALDING.

FLYING MACHINE.

No. 398,984. Patented Mar. 5, 1889.

Fig. 1.

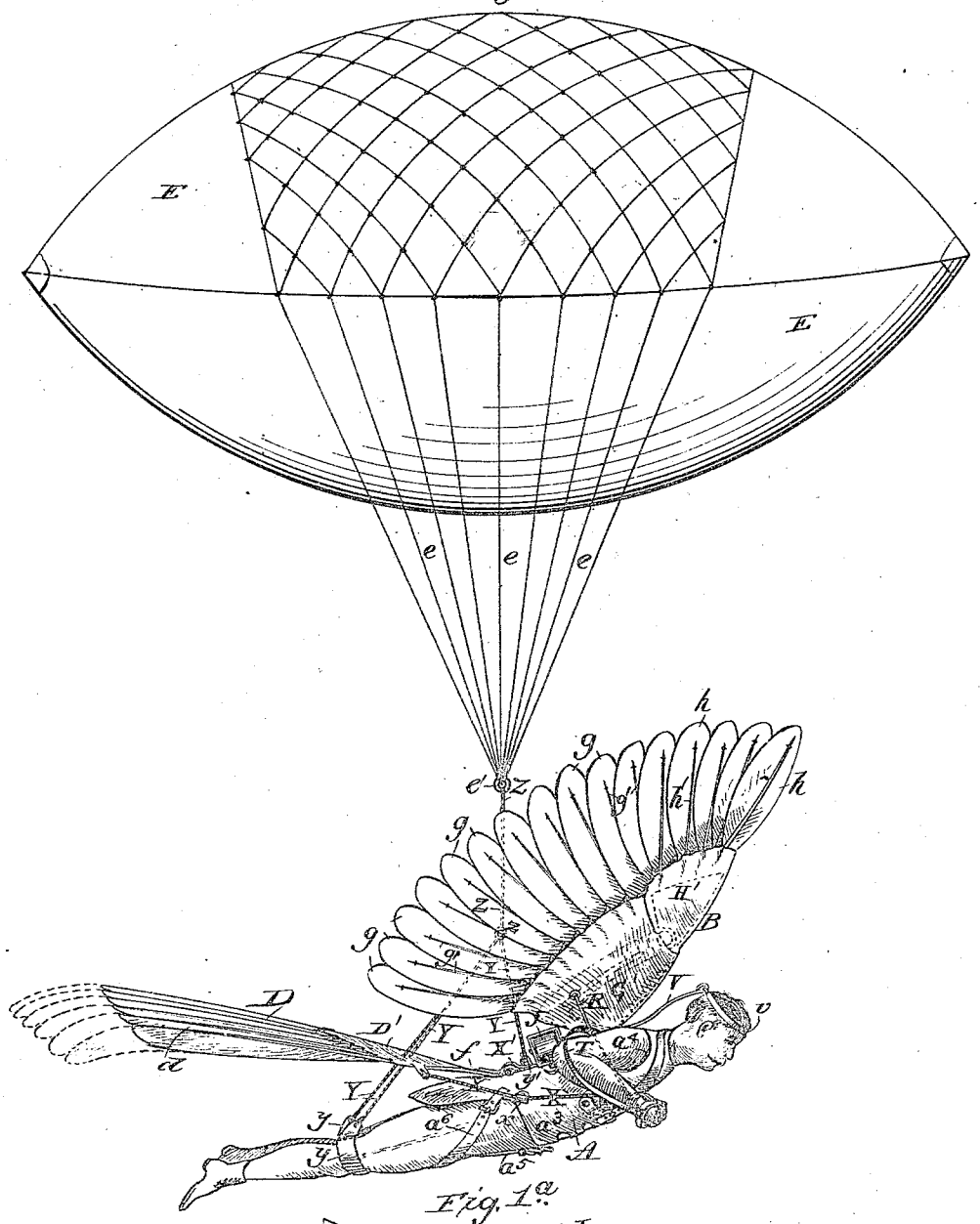
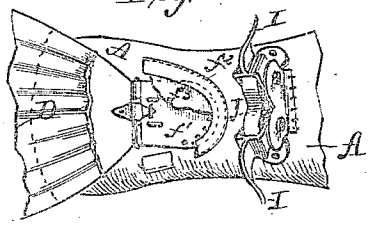


Fig. 1a.



WITNESSES:

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ATTORNEYS.

(Model.) 5 Sheets—Sheet 2.

R. J. SPALDING.

FLYING MACHINE.

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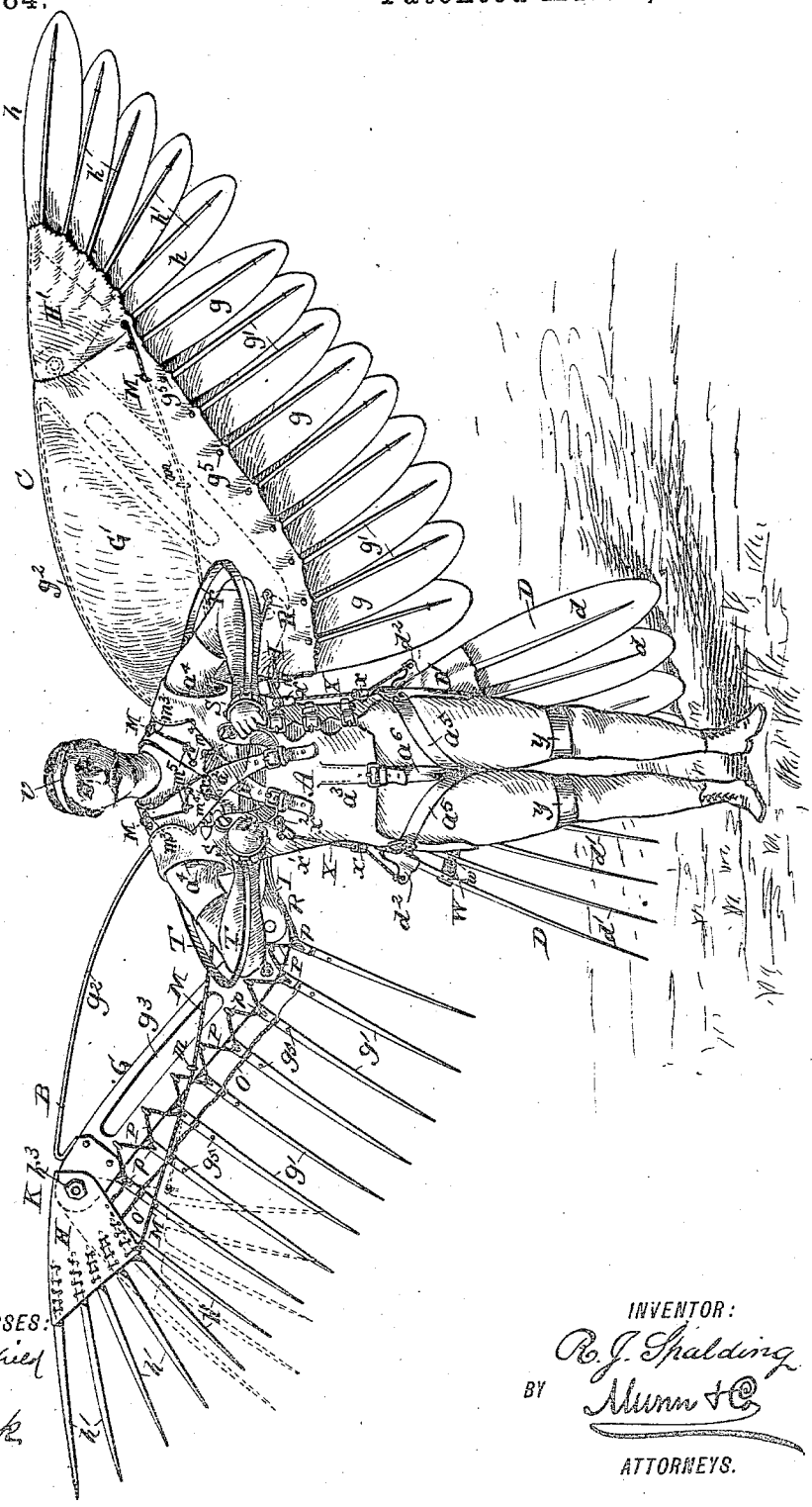
Fig. 2.



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(Model.) 5 Sheets—Sheet 3.

R. J. SPALDING.

FLYING MACHINE.

No. 398,984. Patented Mar. 5, 1889.

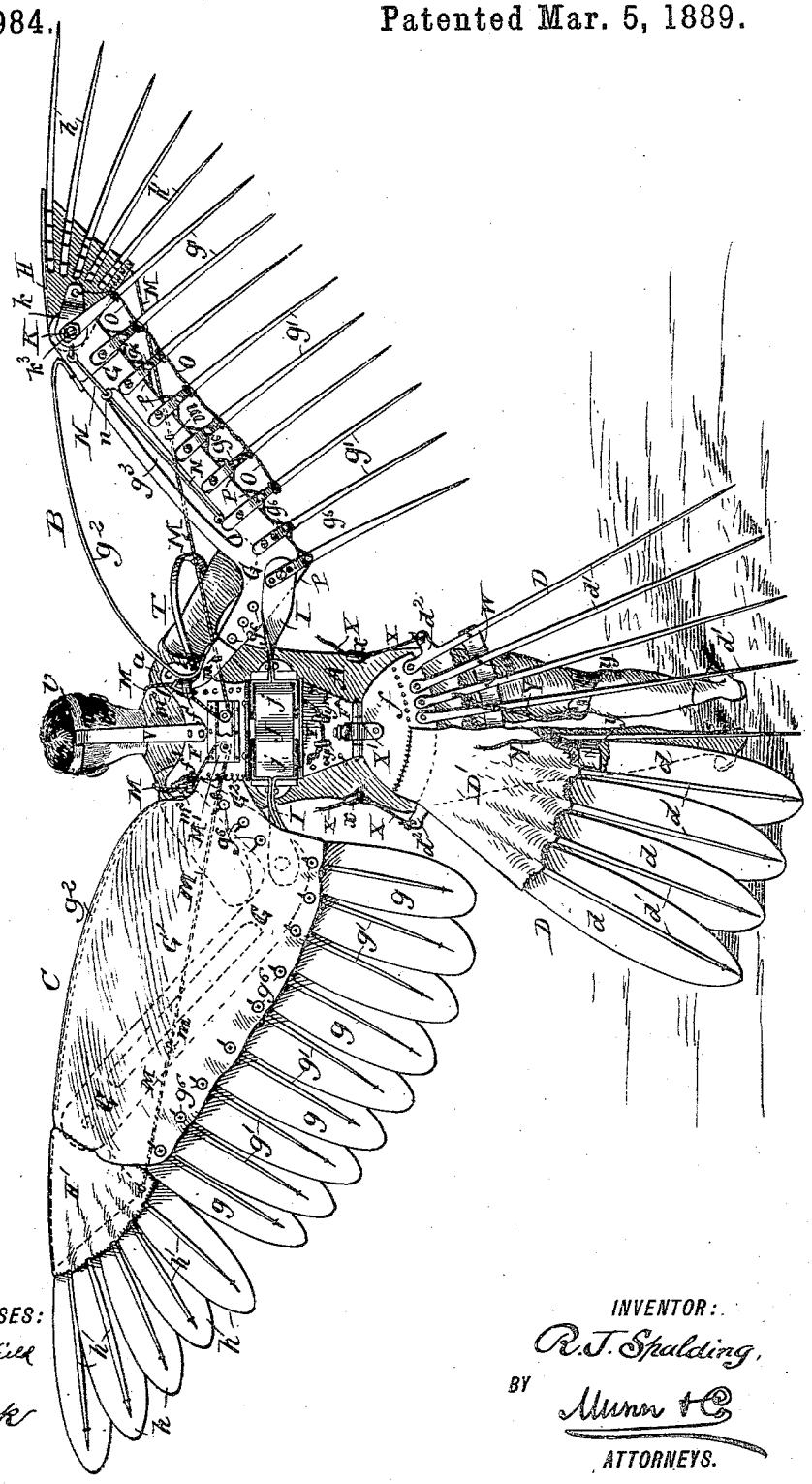

Fig. 3.

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(Model.) 5 Sheets—Sheet 4.

R. J. SPALDING.

FLYING MACHINE.

No. 398,984. Patented Mar. 5, 1889.

Fig. 4.

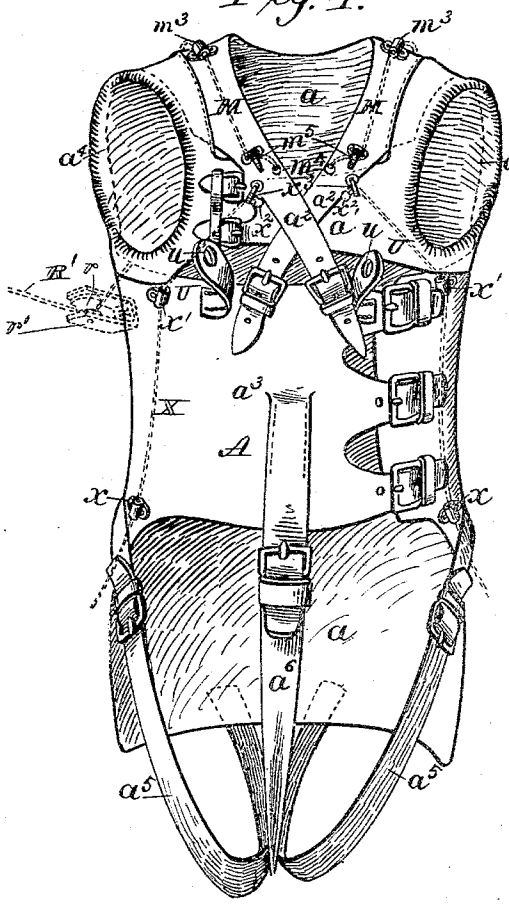


Fig. 5.

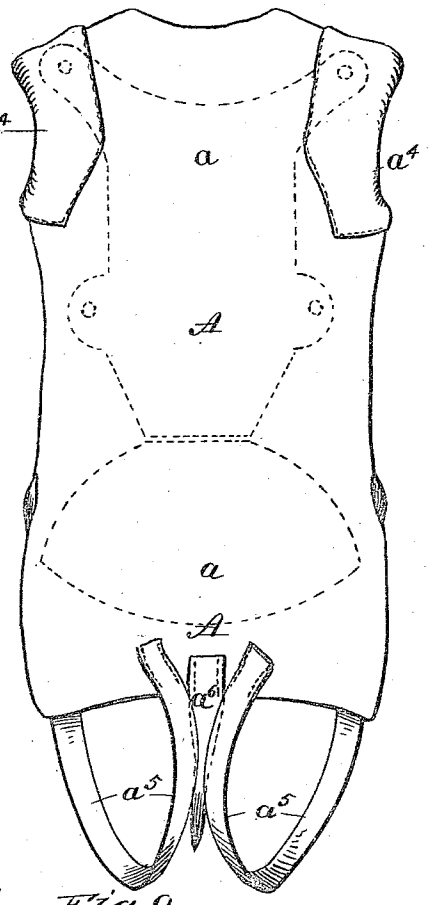


Fig. 6.

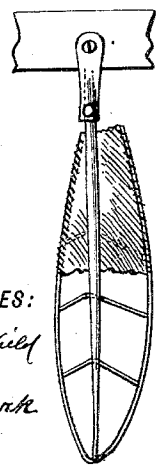


Fig. 7.

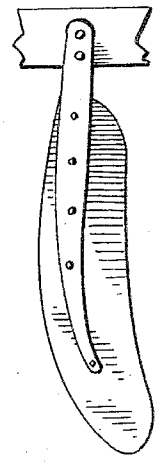
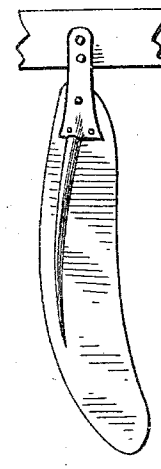


Fig. 8.



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(Model.) 5 Sheets—Sheet 5.

R. J. SPALDING.

FLYING MACHINE.

No. 398,984. Patented Mar. 5, 1889.

Fig. 9.

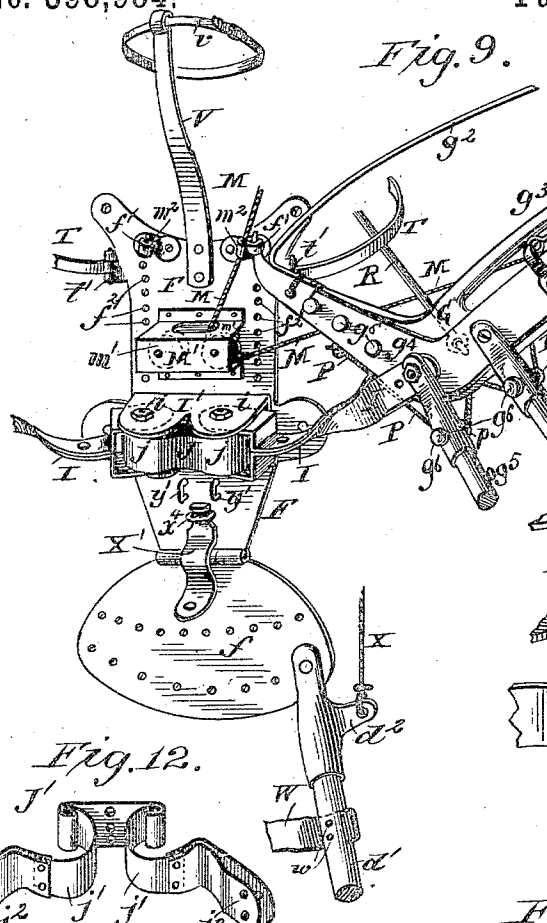


Fig. 10

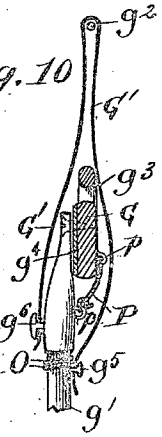


Fig. 11.

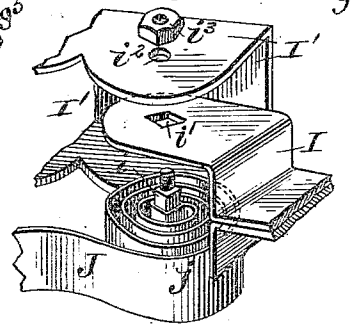


Fig. 12.

Fig. 13.

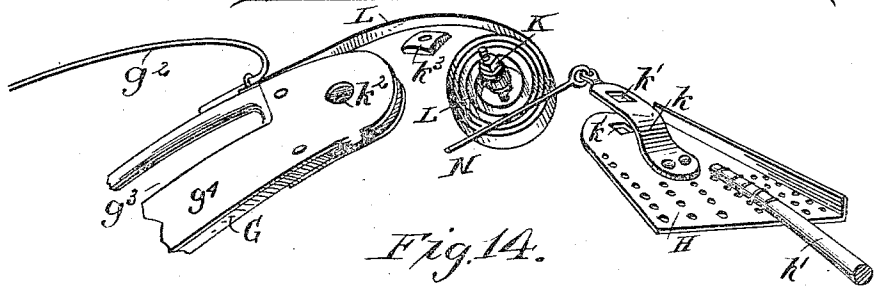
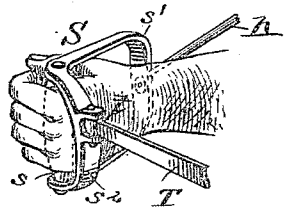


Fig. 14.



WITNESSES:

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E. M. Clark

INVENTOR:

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ATTORNEYS.

UNITED STATES PATENT OFFICE.

REUBEN JASPER SPALDING, OF ROSITA, COLORADO.

FLYING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 398,984, dated March 5, 1889.

Application filed September 1, 1888. Serial No. 284,340. (Model.)

To all whom it may concern:

Be it known that I, REUBEN JASPER SPALDING, of Rosita, in the county of Custer and State of Colorado, have invented a new and Improved Flying-Machine, of which the following is a full, clear, and exact description.

My invention relates to a machine for navigating the air, and has for its object to provide a simple, comparatively inexpensive, easily-operative, and efficient apparatus of this character.

The invention consists in certain novel features of construction and combinations of parts of the flying-machine, all as hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of my improved flying-machine as it appears when in use by an aeronaut. Fig. 1ª is a detail perspective view illustrating a different connection of the tail of the machine with the aeronaut's jacket than that shown in Fig. 1. Fig. 2 is a front view of the aeronaut standing on the ground, and shows the right wing and a portion of the tail of the flying-machine with feathers and webbing removed. Fig. 3 is a rear view of that shown in Fig. 2. Fig. 4 is an enlarged front view of the aeronaut's jacket. Fig. 5 is a rear view thereof, with the metal back plate indicated in dotted lines. Figs. 6, 7, and 8 are views of feathers of modified forms, with their different attachments to the wing or tail of the machine. Fig. 9 is an enlarged rear detail perspective view of the metal back plate of the jacket removed therefrom and part of the right-wing frame and other connections to the plate. Fig. 10 is a transverse section of the wing. Fig. 11 is a detail perspective view of the lower joint of the wing to the jacket or its back plate. Fig. 12 is a modified form of spring attachment by which the wings may be connected to the jacket or its back plate. Fig. 13 is a perspective view of disassembled parts, illustrating the manner of connecting the main lever and outer plate or part of the wing-frame; and Fig. 14 is a detail perspective view showing the aeronaut's hand-grasp and its connections to a wing-operating rod and auxiliary spring.

My improved flying-machine consists of a jacket, A, adapted to the body of the aeronaut, right and left wings, B C, and a tail, D, held to the jacket, and a balloon, E, from which the aeronaut is suspended by connections to the jacket and to straps or bands encircling his legs, all as shown in Fig. 1 of the drawings, and as will be hereinafter more particularly described in the order above mentioned.

The aeronaut's jacket A (shown most clearly in Figs. 4 and 5 of the drawings) is preferably made mainly of leather; but it may be made mainly of cloth or any other suitable material or fabric. It has an elongated main or back portion, a, and a front consisting mainly of a breast-belt, a', two shoulder-belts, a^2 a^2, and a broad body-belt, a^3, all having suitable buckle-and-strap connections with the main part of the jacket, which is provided with holes a^4 a^4, through which the aeronaut will slip his arms prior to buckling the jacket around his body. A couple of straps, a^5 a^5, fastened at one end to the bottom of the jacket-back a, are brought up between the aeronaut's legs, and thence diagonally across his thighs, and are buckled to tabs at the sides of the jacket, and another belt, a^6, also connected to the middle lower part of the back a, is brought around between the aeronaut's legs, and is buckled to a tab at the central lower portion of the broad body-belt a^3, and whereby when all these belts are buckled the jacket will be held very tightly to the aeronaut's body, as shown in Figs. 1, 2, and 3 of the drawings, and will be secure against slipping in any direction, so as to provide a firm and substantial connection of the wings and tail of the apparatus, which is accomplished, preferably, by the use of a thin light but tough metal plate, F, which I hold to the back of the jacket, preferably by riveting it thereto, perforated lugs or flanges being provided on the plate for passage of the rivets; or, if preferred, the plate may be connected to the jacket by stitching it thereto by strong thread or cord; or any other secure mode of attachment may be adopted. The general form of

this plate F, to which the two wings are attached, and also of the plate *f*, which is hinged to the one F, and to which the tail is connected, is shown most clearly in Figs. 3 and 9 of the drawings.

Both of the wings B C are alike in structure and mode of operation; hence a particular description of one wing and its appurtenances will suffice, as follows: The wing is made with an angle-lever or main-frame portion, G, and an outer plate portion, H, to which, respectively, are connected outwardly-extending rods *g' h'*, which form the main stems of the air-resisting planes or feathers *g h* of the wing. The shorter inner arm of the main lever G is fulcrumed at its extremity to an eye or bearing, *f'*, on the plate F at one shoulder of the aeronaut, and at its angle the lever is fixed to the outer end of an arm, I, which has a forked inner end which is pivoted on a pin or shaft, *i*, to a flanged metal plate, I', fixed transversely to the back plate F of the aeronaut's jacket, and the pin *i*, which forms the lower fulcrum of the wing, is connected to one coiled end, *j*, of a duplex spring, J, the other coiled end, *j*, of which is connected to the fulcrum-pin *i* of the other wing, which has an upper fulcrum in a bearing, *f'*, on the plate F at the other shoulder of the aeronaut. (See Fig. 3 of the drawings.) The middle portion of the wing fulcrum-pin *i* is formed square and the end of the spring-coil *j* is fixed to this squared or flat-sided part, which projects sufficiently beyond the edges of the spring each way to enter square or flat-sided holes *i'* at the forked end of the arm I, and the two ends of the pin *i* are rounded to form journals which enter holes i^2 in the plate I' and receive nuts i^3 outside the flanges or walls of the plates. With this construction it is obvious that as the wing is brought downward the spring-coil *j* will be wound up or put in tension, and on the completion of the downstroke the coil will by its expansive force in unwinding again raise the wing. The means for imparting the downward stroke to the wing by movement of the aeronaut's arm, aided by a spring which is put in tension as the wing moves upward, will be hereinafter explained.

The wing-frame lever G is provided with a rod, g^2, which reaches from the extremity of its short arm to the outer end of its long arm, and serves not only as a brace to the lever, but also as a frame-rod over which to stretch the webbing fabric G', which forms the upper inner air-resisting plane or surface of the wing. The long arm of the main wing-lever may be made solid; but it is preferably slotted longitudinally at g^3, like the second-joint bones of a bird's wing, and the lever, which is preferably made of wood, may be strengthened by a metal re-enforcing plate, g^4. (See Figs. 9, 10, and 13 of the drawings.) The webbing fabric G' is held at one edge to the inside of the wing by means of a series of pins, g^5, fixed to the inner face of the feather-stems *g'* and the short arm of the main lever, and the other or front edge of the fabric is preferably provided with a series of button-holes, which are engaged with buttons g^6 at the outer faces of the feather-stems and the short arm of the main lever, as shown in Figs. 2 and 3 of the drawings. The space between the inner short arm of the main wing-frame G and the upper portion of the jacket A, or of the metal plate F thereon, is also closed by a webbing fabric, G^2, which may be an inward extension of the main webbing fabric G', and is secured by sewing or tying it to the adjacent side edge of the plate F, which is provided with a series of edge holes, f^2, to receive the attaching threads or cords; or this inner webbing fabric, G^2, may be made separate from the fabric G', or may be held to the wing-lever by pins and buttons, substantially as above described for the fabric G'.

The plate H, which is the outer portion of the wing-frame, is peculiarly connected to the main lever G of the wing as follows and as most clearly shown in Fig. 13 of the drawings: The inner narrower portion of the plate is provided with a square or flat-sided hole, *k'*, opposite a like hole, *k'*, in a bent plate, *k*, which is fixed at its outer end to the plate H. A coiled spring, L, which is held at one end to the extremity of the main wing-lever G, is fixed at its other end or at the inner part of its coil to a pin or shaft, K, which projects by rounded parts of it each way beyond the edges of the spring, so as to enter round holes k^2, formed at the end of the lever G, and beyond these rounded parts the ends of the pin K are squared or made flat-sided to fit the holes *k'* *k'* in the plates H and *k*, outside of which plates the pin or fulcrum-shaft K receives nuts k^3 onto its rounded threaded extremities to hold the spring-joint in place. With this construction it is obvious that the outer plate, H, will normally be extended or swung outward by the uncoiling tendency of the spring L, and the plate H and its attached air-resisting plates or feathers *h* may be contracted or folded inward to reduce the air-resisting area of the wing by drawing in the plate H, so as to fold some of its feathers beneath the feathers *g* of the main part of the wing, and which I accomplish by means which also simultaneously contract or fold to a lesser degree most of the feathers *g* of the main part of the wing, as next described.

To the inner rear corner of the plate H is attached one end of a cord, M, which is passed inward through guide-eyes *m m* on the wing-frame lever G to and around a guide pulley or roller, *m'*, journaled in a metal case or housing, M', fixed to the back of the jacket-plate F and in said plate. From this pulley the cord is rove through an eye or loop, m^2, at the upper corner of the plate F and next the upper wing pivot or fulcrum, *f'*, and from this eye or loop the cord is passed forward over the shoulder of the aeronaut and through another eye or loop, m^3, fixed to the adjacent shoulder-strap a^2 or neck-band of the jacket

A, and the extremity of the cord is knotted at m^4, to prevent its being pulled or blown backward through or out of the loop m^3, and also allow the cord to be caught by its knotted end into an open-hook detent, m^5, which is fixed to the front of the aëronaut's jacket, and preferably to one of the front straps, a^2, thereof. It is manifest that should the aëronaut pull on the cord M, which is in easy reach at his shoulder, the outer wing-plate, H, and its attached feathers *h* will be drawn inward and partly folded edgewise under the wing-lever G and the feathers *g* thereof, and these relative positions of the parts may be maintained by hooking the knotted end of the cord into the detent m^5, and the cord may have several knots, m^4, on it to engage the detent to hold the outer part, H *h*, of the wing folded under the main part G *g* thereof to any desired extent, as atmospheric conditions or the strength of the aëronaut may require. To cause this infolding of the outer wing-frame, H, to contract or fold inward the outer feathers, *g*, the stems *g'* of which are pivoted at their inner ends to the main wing-frame G, the plate *k*, which is fixed to the wing-plate H and turns with it and with the fulcrum-shaft K, is provided with an eye or lug, to which is attached one end of a rod, N, which extends inward through a suitable eye or staple-guide, *n*, and ranges, preferably, through or along the slot g^8 of the wing-frame lever G, and at its other end is connected to an upward extension of one of the stems *g'* of an inner feather, *g*. It may be the innermost one or the second one; but I show the inner end of the cord connected to the third feather-stem, and the stems of all the feathers *g*, from or outside of the one to which the cord N is fastened, are connected by a pull-cord, O, which is also fastened at its outer end to the plate H, but so as to allow sufficient slackness of the cord to permit folding movement of the feathers. It is obvious as the cord M is drawn upon and the wing-plate H is folded inward, as above described, that the rod N will be drawn outward and the feather-stem *g'*, to which this rod is connected, will be moved inward, and as this stem pulls on all the outer feather-stems by the cord O, connected to it and to them, the outer feathers of the main part of the wing will also be folded inward more or less, depending on the draft on the cord M and as circumstances may require, and when the cord M is released from the detent m^5 the spring L will instantly throw or swing the wing-section H *h* and the movable feathers *g* of the main wing-section outward into fully-expanded condition.

It will be understood that the outer feathered frame, II *h*, may alone be arranged to fold edgewise; but by making it and also most of the feathers *g* of the main wing-section adjustable, as described, the wing may be contracted or enlarged in area to quite an extent to adapt the same flying-machine for use by persons of varying strength and under widely-different atmospheric conditions.

The feathers may be held to the outer plate, H, by cords or threads passed through holes of the plate and over the butts of the feathers; or these feather-stems may be riveted to the plate, so as to be immovable edgewise, as are the two inner feathers, *g*, on the wing-frame lever G. The plate H and the butts of the feathers *h* will be covered by a web fabric, H', made of leather, cloth, silk, or any other suitable material, sewed or stitched to or around the plate or fastened thereto in any other approved way. The outer wing-plate, H, is preferably made of aluminum; but it may be made of any thin and tough metal or other material.

To stay one feather *g* to the other all along the main wing-lever G, I have fixed in the lever a series of eyes or staples, *p*, and a series of like staples, alternating in position with those on the lever, are fixed to the inner faces of the feather-stems or their sockets, and a strong cord, P, is rove in zigzag course through all these eyes or staples, the cord preferably being slipped loosely through the lever-eyes *p* and being knotted at the feather-stem eyes, and the opposite ends of the cord P are or may be fixed, respectively, to the plate H and at the angle of the main lever G, as shown in the drawings. This cord or lacing permits adjustment of the feathers edgewise, as above described, and stays the feathers to and from each other to make the entire wing-structure more staunch when the machine is in use.

The mechanism for operating the wings by the hands and arms of the aëronaut, and which acts in conjunction with the wing-raising spring J, above described, is made as follows: A pull-rod, R, is connected to the inner end of the wing-lever G and extends forward and is provided with a hand-grasp or handle, S, to which also is shackled at *t* one end of a spring, T, preferably having a curved-plate form and connected pivotally at its other end at *t'* to the upper part of the jacket-plate F at the shoulder of the aëronaut and near the upper fulcrum, *f'*, of the wing. The handle S may be made as shown in Fig. 14 of the drawings, or with a cross-bar, *s*, to be grasped by the aëronaut and journaled at its angle, and with two loops, s' s^2, to which, respectively, the pull-rod R and spring T are attached. The normal effect of the spring T is to help give a downstroke to the wing after the upstroke thereof has been effected by the stronger spring, J, at the back of the jacket.

To operate the wings, which are made alike, as above stated, the aëronaut will grasp the handles S S, one by each hand, and while the spring J raises the wings the aëronaut will bend his arms at the elbows to cause his hands to approach his breast, and he will then straighten out his arms directly from his body, and thus pull on the rods R R, and will also be assisted by the application of the power of

the auxiliary springs T T, which had been stored up in them when the wings had been last raised by the spring J, and the force of gravity, due to the weight of the wings themselves, will also assist in producing the downstroke of the wings, it being understood that the balloon E, from which he is suspended, has sufficient lifting force to hold up the aeronaut, less a few pounds, which is all the dead-weight to be overcome by the operation of the wings, which may thus be effected with comparative ease for a considerable time without tiring the aeronaut, and this dead-weight, little as it is, enables the aeronaut to alight at any time or to take any desired downward sweep by simply stopping the motion of the wings, and at these times and to promote the comfort of the aeronaut, and while the wings lie in about the same plane as his body, he may slip his thumbs into holes *u u*, made in straps U U, which are fastened at one end to the front of his jacket A, and as represented in Fig. 2 of the drawings, and sail through the air at ease.

A spring-plate, V, which is fastened at its lower or inner end to the upper part of the plate F of the jacket A, carries at its outer end a band or strap, *v*, into which the aeronaut slips his head to support it and prevent strain of his neck and shoulder muscles, and thus promote his comfort and safety in flight, and as will be most clearly understood from Fig. 1 of the drawings.

I particularly describe the tail D of the flying-machine as follows: The tail-feathers *d* are held by their stems or rods *d'* to the back or lower end of the plate *f*, which may be hinged to the main plate F, as shown in Figs. 1, 3, and 9 of the drawings, or may be hinged to a separate plate, *f'*, riveted to the aeronaut's jacket A, as shown in Fig. 1ª of the drawings. When the last-named construction is adopted, I will fasten a leather, cloth, or other flexible fabric strip, f^2, to the jacket A, so that said strip overlaps the top and side edges of the plate *f* and allows connection to it by sewing or otherwise of a covering fabric, f^3, for the plate. The tail-feathers *d* may be fixed to the plate *f*, if desired; but I prefer to pivot the feather-stems to the plate to allow lateral edgewise motion of the feathers, which lap one on the other like the wing-feathers above described. To the feather-stems *d'*, and a little below the plate *f*, is fastened, by rivets *w* or otherwise, an elastic or contractile structure, preferably a strap or band, W, which holds the feathers in a normal position edgewise relatively to each other. The outer feather-stems, *d' d'*, at opposite sides of the tail are provided with laterally-extending lugs or projections d^2 d^2, to each of which is connected a pull rope or cord, X. The cord X of each of the other feathers extends upward to and through a guide eye or loop, *x*, which is fixed to the aeronaut's jacket about at his hip, and passes thence to and through another guide eye or loop, *x'*, on the breast of the jacket, and is knotted at x^2 above or behind said eye or loop. The knot x^2, or any one of several of them on the cord, prevents escape of the cord from the eyes or loops and holds the cord in easy reach of the aeronaut, who by pulling on it will draw on the outer side feather *d* of the tail, which is connected to the cord, and this outer feather, being connected to the inner ones by the elastic band W, will by or through the band draw the inner feathers outward also, and thereby expand the tail-feathers more or less, and the knots x^2 of both the cords X may be caught into hooks x^3 x^3, fastened to the breast of the aeronaut's jacket A, to hold either or both side series of the tail-feathers at any desired degree of expansion, to vary the area of the tail as different atmospheric conditions and the direction of flight of the aeronaut may require.

A metal plate, X', preferably riveted at one end to the tail-plate *f* and held at its other end within a staple or loop, x^4, fixed to the main plate F, acts as a stay or brace to prevent upward movement of the tail on its hinge which the stay-plate overlies, and does not prevent edgewise adjustments of the tail for steering purposes. If desired, the tail-plate *f* may have a fixed instead of a hinged connection to the main plate F or to the plate *f'*. A webbing fabric, D', which may be like the webbing fabrics G' of the wings B C, is secured to the tail-plate *f*, preferably by stitching through holes in said plate, and this webbing also covers the upper parts of the tail-feathers, and may be held to them in any approved manner.

The aeronaut when in flying trim is connected to the balloon E by means of ropes Y Z, the two ropes Y being connected at one end to bands or straps *y*, which encircle the knee-joints of the aeronaut or his legs just above the knees, and the other ends of said ropes are connected to eyes or staples *y' y'*, which are fixed to the metal back plate, F, of the jacket A. Both the ropes Y Y are passed through the tail-webbing D', and are connected to a ring, *z*, to which is attached the lower end of the rope Z, the upper end of which is connected to a ring or swivel, *e'*, to which the suspension cords or ropes *e* of the balloon are fastened, all as most clearly shown in Fig. 1 of the drawings.

I am not limited to the use of the double coiled spring J for raising the wings of the flying-machine, as other forms of springs may be used—as, for instance, a spring, J', (shown in Fig. 12 of the drawings,) which consists of a transverse plate having holes to receive rivets or bolts for fastening it to the jacket-plate F and looped and bent around at opposite ends to form bowed plate-springs *j' j'*, which at their outer ends are provided with clamp-plates j^2 j^2, which will overlap and be riveted to opposite sides of the main lever G of each

wing, substantially as above described for the clamp-arms I, which are held to the coils *j* of the spring J. I may also use pull-cords R′ instead of the pull-rods R, said cords being connected at opposite ends to the wing-frames and running over pulleys or rollers *r*, journaled in suitable bearing-plates, *r′*, held to the aeronaut's jacket under his arms. (See the dotted lines in Fig. 4 of the drawings.)

The wing and tail feathers of the flying-machine may also be made of different materials. For instance, I may use silk stretched over a light frame and held to the stems or rods of the feathers, which are inserted in sockets held to the wing or tail frame, as shown in Fig. 6 of the drawings; or I may use rawhide cut into proper form and fastened to and between light flat metal or wood plates, which are riveted to the frame, as shown in Fig. 7 of the drawings; or I may use thin plates of metal of proper shape and riveted to short plates, which will be held to the frame of the wing or tail, and as shown in Fig. 8 of the drawings. Any suitable material may be used to form the air-resisting planes or surfaces of the feathers, and the feathers may be either pivoted to the wing or tail frames, or may be fixed thereto by rivets, nails, screws, or otherwise, as may be necessary or convenient. The stems of the feathers will range along one side of the center of the feathers to cause the overlapping parts of the feathers to open to pass the air through the wings on their upstroke and reduce the resistance of the air during the ineffective strokes of the wings.

It will be understood that the flying-machine comprising the wings and tail or the wings alone and their attachments, as above described, may be used advantageously without the balloon. For instance, the cord Z may be suspended from a pulley running on a wire stretched across a chasm or at other place, and the aeronaut may operate the wings to propel himself through the air while he is supported mainly or partly by the wire; or the wings, either with or without the tail, may be applied to vehicles or ice or water boats or an air-boat or frame-work, and the wings may be operated by man or animal or electro-magnetic or any other power for moving the vehicle or boats or frame-work forward.

When the aeronaut is flying, the wings operate with practically the same effect as the wings of an eagle, and the aeronaut may easily turn either way by holding one of the wings in horizontal position and working the other wing, and he may assist himself in taking a different course by laterally spreading either side portion of the tail. The back end of the tail may be bent or curved downward, as indicated in dotted lines in Fig. 1 of the drawings, to offer sufficient resistance to the air to prevent any sudden backward lurch of the balloon from tipping the aeronaut over backward when in flight. It is obvious that the aeronaut has ample power to direct his course and fly with the wind or diagonally across it, or to any point of the compass in a calm, as he may desire. As the wings flap up or down, the flexible portions of their feathers bend, and while bent they are trying to straighten, and this action or tendency pushes the man or craft forward, producing headway, while at the same time the alternating pressure of the front ends of the feathers downward and upward, which takes place while the bent feathers are trying to straighten, counteracts the unfavorable action of the web portions of the wings and consequently produces an equilibrium.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with a plate or support to be secured to the back of an aeronaut, of spring-elevated wing-levers hinged to said plate to swing vertically and inclined outwardly and forwardly therefrom, and separate flexible feathers secured at their front ends to and projecting rearwardly from said levers and alternately overlapped along their longitudinal edges, substantially as set forth.

2. The combination, with a plate or support to be secured to the back of an aeronaut, of vertically-swinging elbow-levers hinged at their angles to the said plate or support behind the shoulder portions thereof, with their short arms inclined inwardly and provided with bearings on the shoulder portions of the plate or support, the long arms of said levers projecting forwardly and outwardly, and separate and independent feathers secured at their front ends to said long arms extending rearwardly therefrom and overlapping alternately along their longitudinal edges, substantially as set forth.

3. In a flying-machine, the combination, with a support to be secured to the back of an aeronaut, of vertically-swinging wings having bearings on said support, springs acting on the wings at their pivots or axes to raise them, and operating-connections, substantially as described, leading from the wings to points within reach of the aeronaut, substantially as set forth.

4. In a flying-machine, the combination, with a jacket or support for the aeronaut, of a pair of wings fulcrumed on the jacket, a spring, J, held to the jacket and having opposite end coils, *j j*, and arms I I, connected to the wings and fulcrumed to the spring-bearings, and connected to the spring-coils which raise the wings, and operating-connections, substantially as described, connected to the wings and in reach of the aeronaut for lowering the wings, substantially as herein set forth.

5. In a flying-machine, the combination, with a jacket or support for the aeronaut, of a pair of wings fulcrumed on the jacket, a spring connected to the jacket, and also to the

wings, and operating normally to raise the wings, and auxiliary springs connected to the wings and operating to assist the aeronaut in lowering the wings, substantially as herein set forth.

6. In a flying-machine, the combination, with a jacket or support for the aeronaut, of a pair of wings fulcrumed thereto, a spring connected to the jacket, and also to the wings, and operating normally to raise the wings, operating-connections, substantially as described, connected to the wings and to hand-grasps for the aeronaut, and plate-springs T, connected to the jacket and to the hand-grasps, and assisting the aeronaut to lower the wings, substantially as herein set forth.

7. In a flying-machine, the combination, with a jacket or support for the aeronaut, of wings fulcrumed thereto and made in inner and outer sections hinged together, and cords leading from the outer wing-sections in reach of the aeronaut, who by pulling the cords will contract or fold the wings edgewise to reduce their area, substantially as herein set forth.

8. In a flying-machine, the combination, with a jacket or support for the aeronaut, of wings fulcrumed thereto and each made with a hinged sectional frame and a spring which normally expands the wing edgewise, and cords leading from the outer wing-section in reach of the aeronaut for contracting or folding the wing-sections to reduce the area of the wings, substantially as herein set forth.

9. In a flying-machine, the combination, with a jacket or support for the aeronaut, of wings fulcrumed to the jacket and made with sectional frames having spring-actuated joints which normally expand the wings, cords leading from the outer wing-sections in reach of the aeronaut and provided with knots for holding the cords, and detents on the jacket with which the cords may be interlocked to hold the wings in contracted condition, substantially as herein set forth.

10. In a flying-machine, the combination, with a jacket or support for the aeronaut, of wings fulcrumed thereto and made in two hinged sections adapted to fold or contract edgewise to reduce the area of the wings, and the feathers of the inner or main wing-section pivoted to their frame, and pull-rod and cord connections from the outer wing-sections to the feathers of the inner wing-sections, substantially as described, whereby as the outer wing-sections are folded edgewise the feathers of the inner wing-sections will also be contracted or folded edgewise, and as the outer wing-section is expanded the feathers of the inner wing-sections will also be expanded, as herein set forth.

11. In a flying-machine, the combination of a jacket or support for the aeronaut and a pair of wings fulcrumed thereto, said wings made with a main lever, G, and feathers or aerial planes g, pivoted thereto, and cords P, interlaced between the lever and feathers, substantially as herein set forth.

12. In a flying-machine, the combination of a jacket or support for the aeronaut and a pair of wings fulcrumed thereto, said wings made with a main lever, G, provided with feathers or aerial planes, as g, an upper rod, g^2, on the lever, and webbing, G′, stretched on said rod and on the frame, substantially as herein set forth.

13. In a flying-machine, the combination of a jacket or support for the aeronaut and a pair of wings fulcrumed thereto, said wings each made with a main lever, G, having feathers g, and an outer plate, H, hinged to the lever G by a spring-joint normally expanding the wing, and having feathers h, a rod, g^2, on the lever G, and webbing G′ H′ on the wing-frame sections G H, substantially as herein set forth.

14. In a flying-machine, the combination, with a jacket or support for the aeronaut, of a tail or aerial plane hinged thereto and comprising a plate, a series of feathers pivoted thereto, an elastic connection between the feathers holding them normally in contracted condition, and pull-cords connected to the outer feathers and leading to the aeronaut, substantially as described, whereby on pulling the cords the tail or aerial plane may be expanded laterally, substantially as and for the purposes set forth.

15. In a flying-machine, the combination, with a jacket or support for the aeronaut, of a tail or rudder hinged thereto and comprising a plate and a series of feathers held thereto, pull-cords X, connected to the tail, and guides x x' and detents, as x^3, on the jacket for the pull-cords, substantially as herein set forth.

16. In a flying-machine, the combination, with a jacket or support for the aeronaut and wings connected therewith and operative by the aeronaut, of a tail or rudder hinged to the jacket and comprising a plate, as f, a series of feathers, as d, held thereto, and a webbing, D′, held to the plate and feathers, substantially as herein set forth.

17. In a flying-machine, the combination, with a jacket or support for the aeronaut and wings connected therewith and operative by the aeronaut, of a head-rest for the aeronaut connected to the jacket, substantially as herein set forth.

18. In a flying-machine, the combination, with a jacket or support for the aeronaut and wings connected therewith and operative by the aeronaut, of an elastic plate, V, connected to the jacket, and a band, v, attached to the plate and adapted to receive the aeronaut's head, substantially as herein set forth.

19. In a flying-machine, the combination, with a jacket or support for the aeronaut, of a tail or rudder hinged thereto, and a stay-

plate, X′, held at the tail-joint and limiting vertical movement of the tail, substantially as herein set forth.

20. In a flying-machine, the combination, with a jacket for the aeronaut, of a metal plate, F, held thereto, a pair of wings, B C, fulcrumed to the plate at *f′ f′* and connected by arms I I to a spring, J, held to a bearing-plate, I′, also fixed to the plate F, springs T, fulcrumed at *t′* to the plate F and connected to the aeronaut's hand-grasps, pull-rods R, connected to the hand-grasps and wings, a head-rest, V *v*, also held to the plate F, and an auxiliary plate, *f*, hinged to the main plate F and carrying the tail D, all arranged for operation substantially as herein set forth.

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Witnesses:
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