L. G. YOUNG.

FLYING MACHINE.

APPLICATION FILED JUNE 14, 1911.

1,109,891.

Patented Sept. 8, 1914.

6 SHEETS—SHEET 1.

Fig. 1.

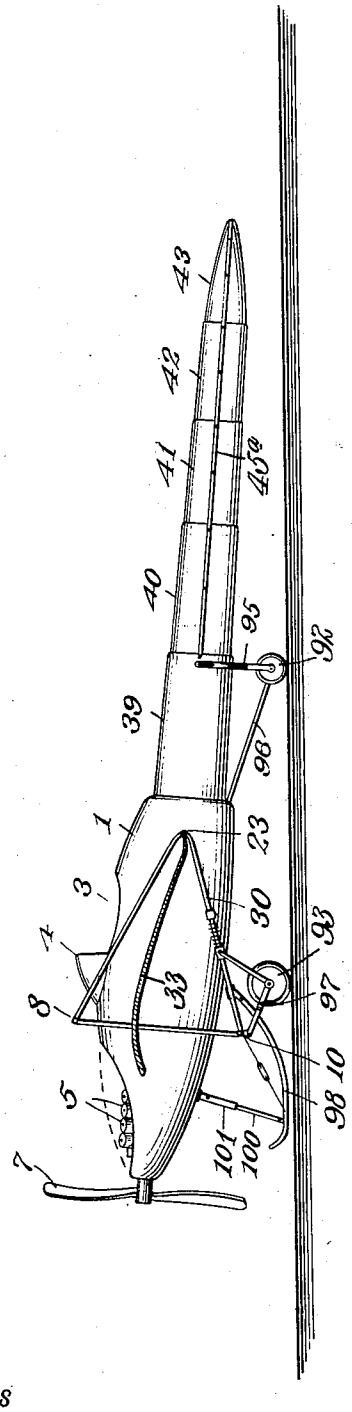
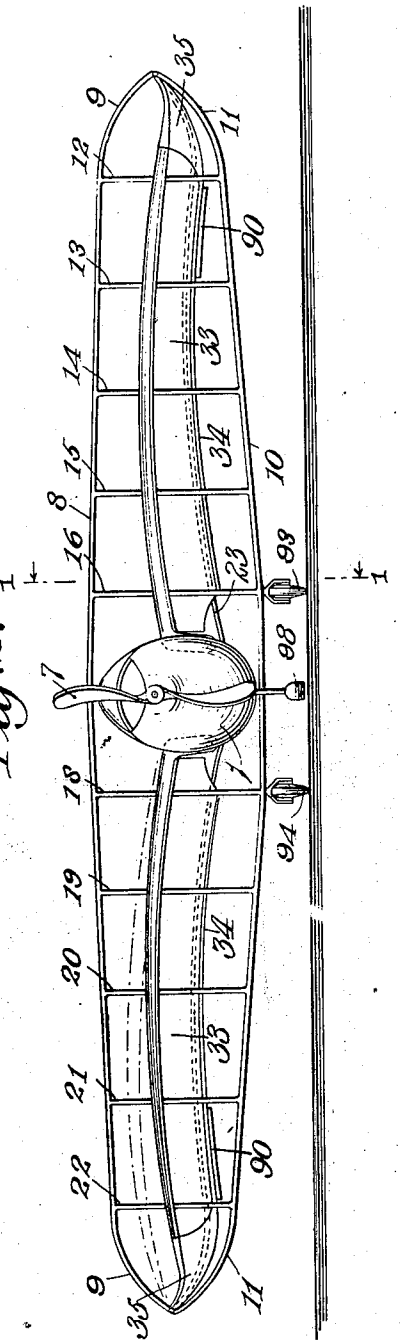


Fig. 2.



WITNESSES

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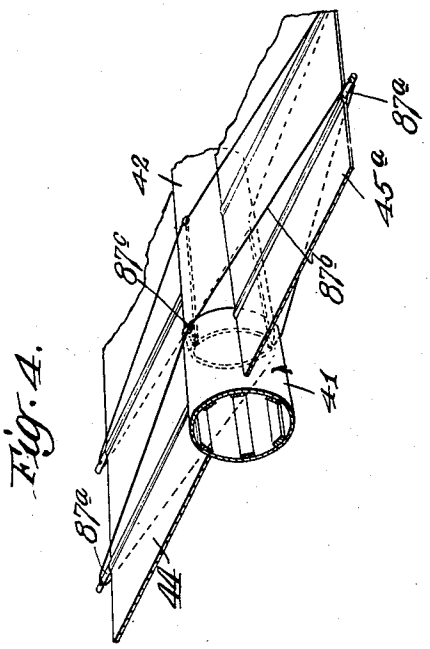

Fig. 4.

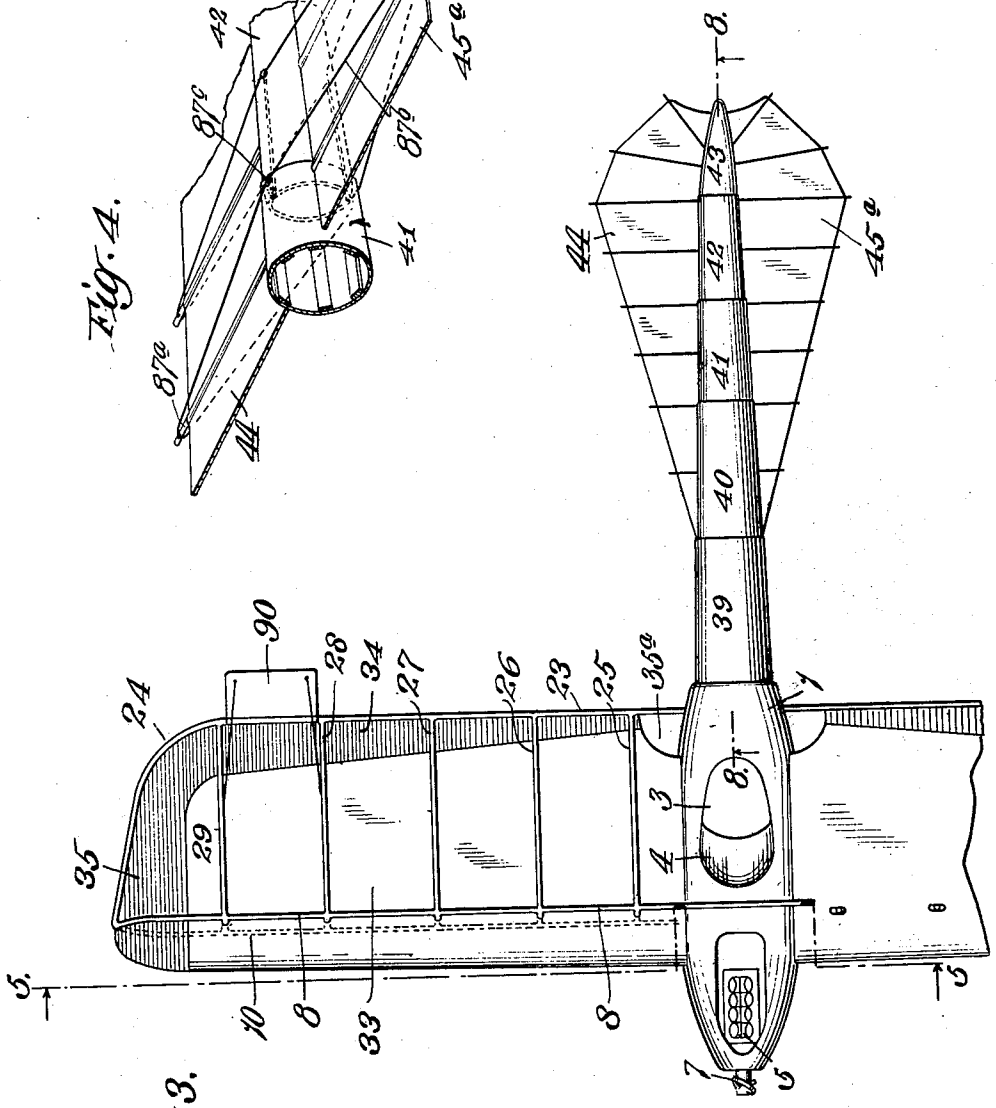

Fig. 3.

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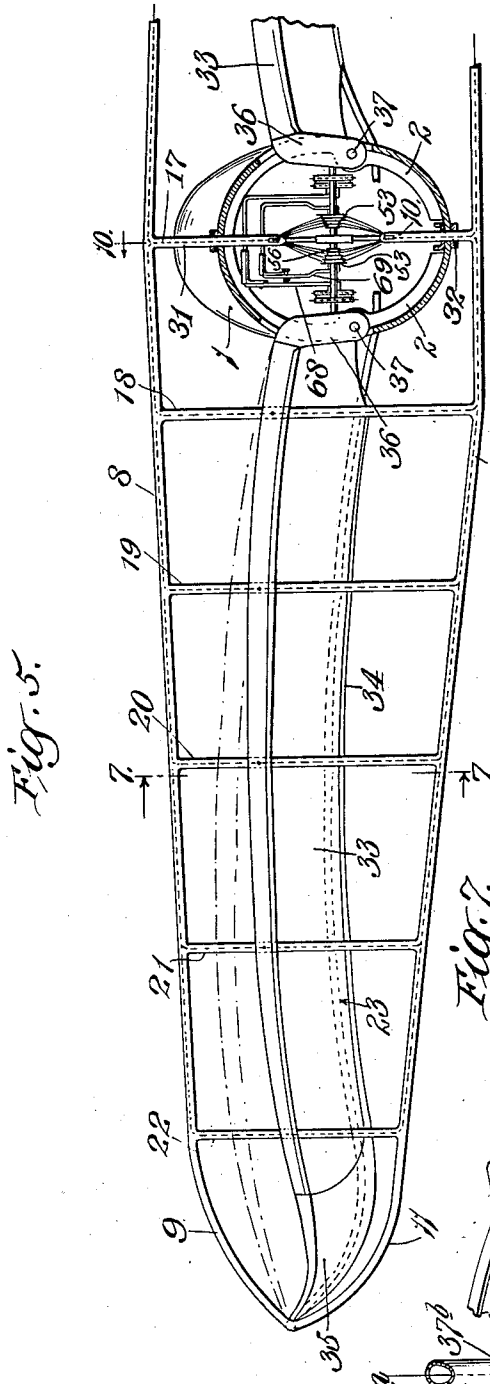

Fig. 5.

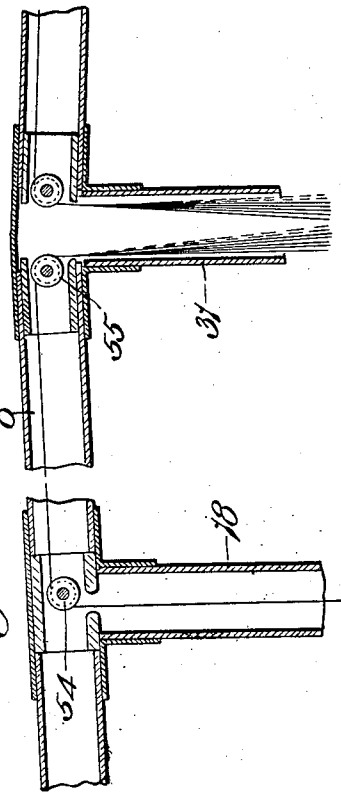

Fig. 6.

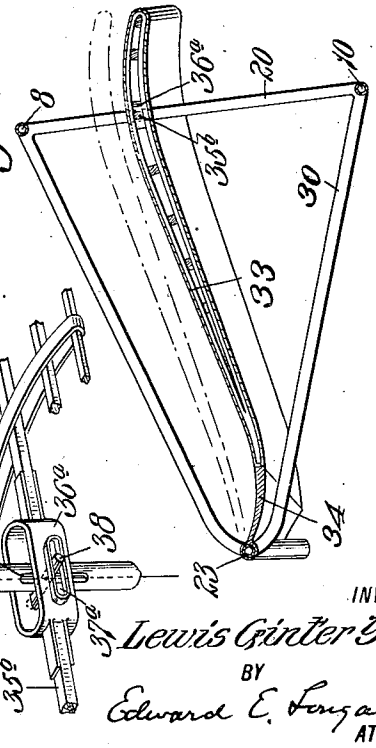

Fig. 7.

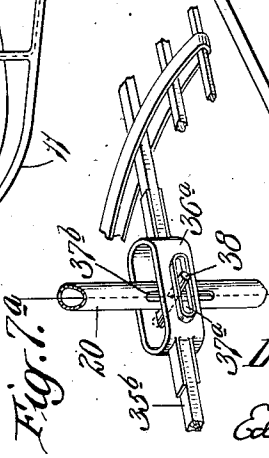

Fig. 7a.

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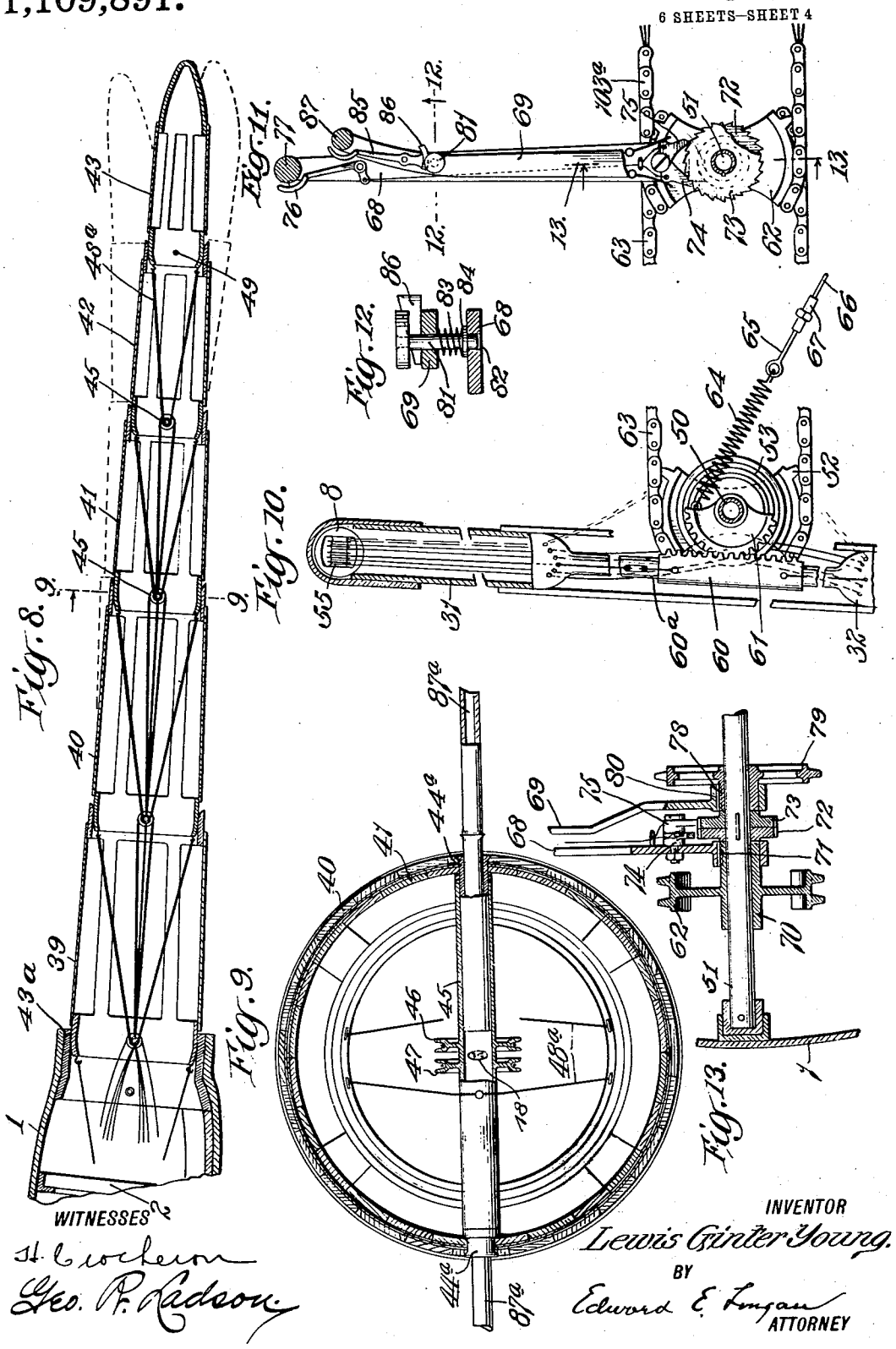
6 SHEETS—SHEET 4



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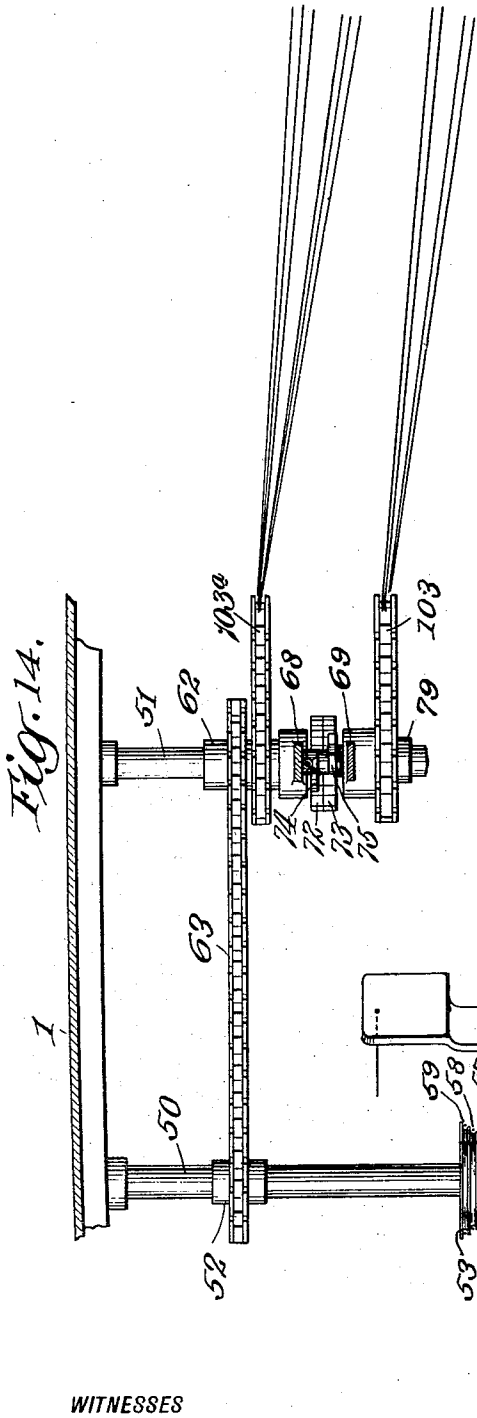
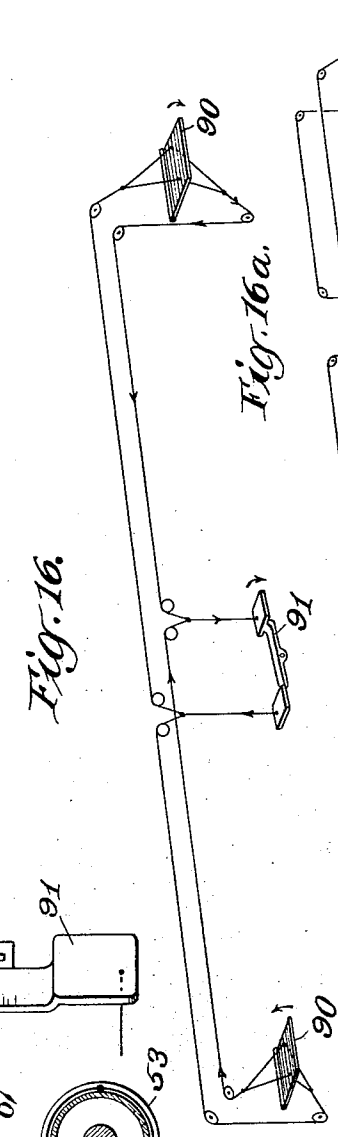
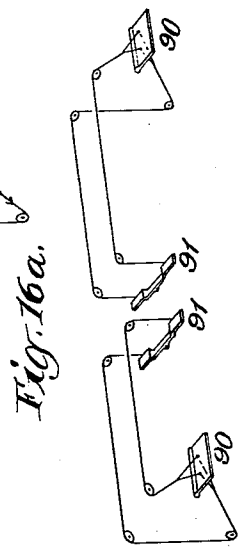
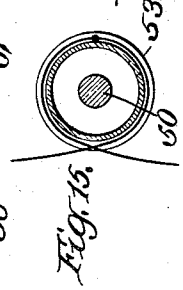
6 SHEETS—SHEET 5.









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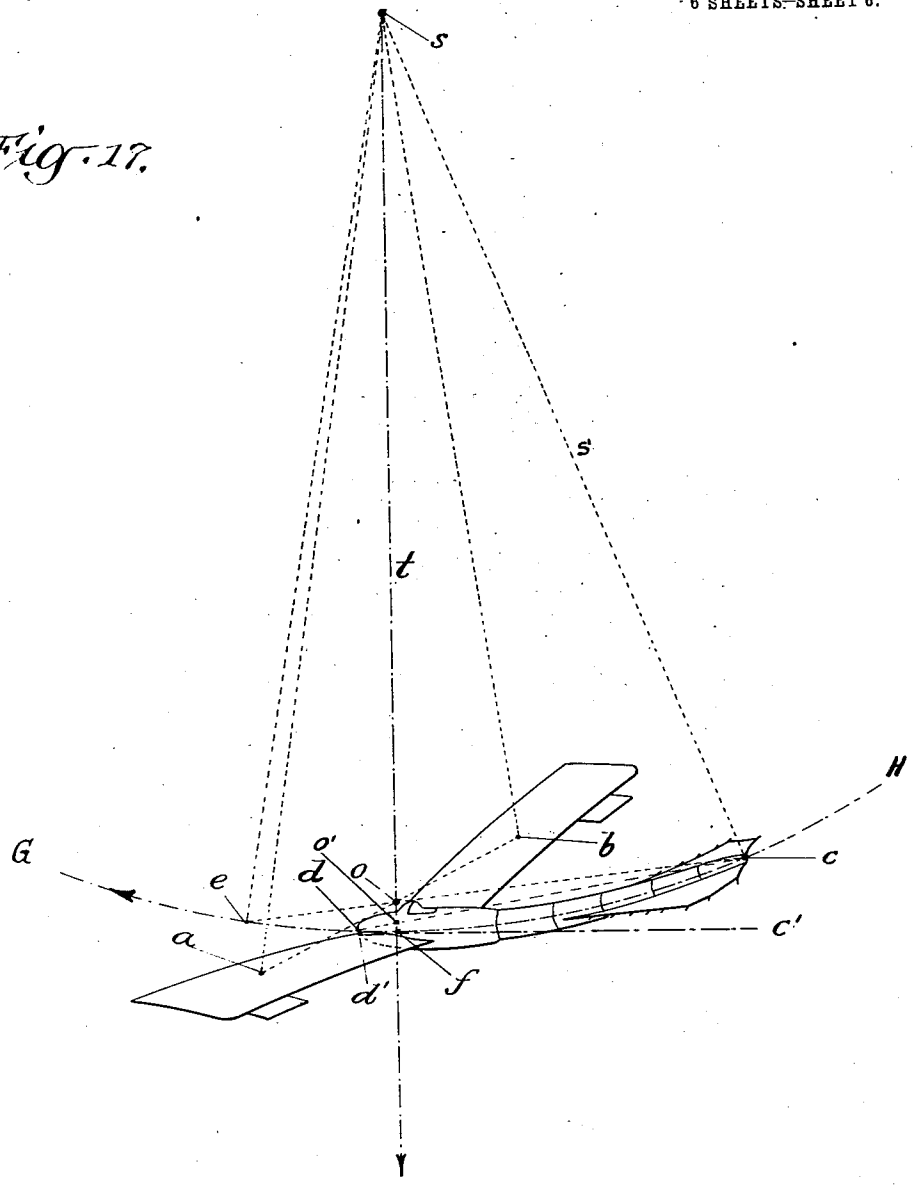
6 SHEETS—SHEET 6.

Fig. 17.



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UNITED STATES PATENT OFFICE.

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FLYING-MACHINE.

1,109,891. Specification of Letters Patent. Patented Sept. 8, 1914.

Application filed June 14, 1911. Serial No. 633,041.

To all whom it may concern:

Be it known that I, LEWIS GINTER YOUNG, a citizen of the United States, and resident of New York city, New York, have invented certain new and useful Improvements in Flying-Machines, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to flying machines, and the principal object of my invention is to construct a flying machine which may be curved or adjusted in arcs of different circles, and have the sum of the supports, regardless of any adjustment of the machine, always perpendicular to the sum of the weights. Furthermore, the supporting surface, force or power of the aeroplane may be increased or decreased at the will of the operator, so that during the ascent, descent or varied stability, the planes may be given the maximum supporting surface or force, or the supporting surface or force of the aeroplanes may be increased or decreased at the will of the operator.

To the above purposes, my invention consists in certain novel features of construction and arrangement of parts which will be hereinafter more fully set forth, pointed out in the claims, and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of my machine with one of the side planes and a portion of the triangular framework in which said plane is mounted, in section; Fig. 2 is an elevation looking toward the front of the machine, the upper dotted lines in the left of said figure indicating one plane elevated for maximum support; Fig. 3 is a top plan view of the machine with a part of one of the side planes broken away; Fig. 4 is a sectional perspective view of a part of two sections of the tail or rear body portion of the machine, illustrating the means by which the fins or balancing planes are curved transversely, either upwardly or downwardly; Fig. 5 is a section taken on the line 5—5 of Fig. 3, illustrating one plane in front elevation, also the triangular framework of one plane in elevation, and showing the wiring, in dotted lines, located in the framework for operating the plane, and the operating mechanism for the plane, tail or rear body portion of the machine in front elevation; Fig. 6 is a vertical section of a portion of the framework showing the wires and pulleys for supporting, lowering and elevating the planes and the horizontal steering planes; Fig. 7 is a section taken on the line 7—7 of Fig. 5, looking toward the body portion of the machine; Fig. 7ª is a detailed view, with parts broken away, showing the method of mounting the side planes on the triangular framework; Fig. 8 is a longitudinal, diametrical, vertical section of the tail or rear body portion of the machine, taken on the line 8—8 of Fig. 3, the metal bands of the tail sections not being shown; Fig. 9 is an enlarged transverse section taken through the tail sections on the line 9—9 of Fig. 8; Fig. 10 is a vertical section taken on the line 10—10 of Fig. 5, showing wiring, rack and segment of a gear wheel in side elevation, and pulleys for the operation of the planes; Fig. 11 is a side elevation of the operating levers, the operating handles and supporting shaft in section, and ratchet wheels. Fig. 12 is a section on the line 12—12 of Fig. 11; Fig. 13 is a section on the line 13—13 of Fig. 11; Fig. 14 is a top plan view of the shafts which carry the operating levers, pulleys and sprocket wheels and connections between the shafts, and illustrating one-half of the mechanism for operating the planes and the tail or rear body portion of the machine; Fig. 15 is a section taken through one of the shafts and one of the cone pulleys, showing the method of affixing the wire thereto; Fig. 16 is a diagrammatical perspective view illustrating the horizontal steering planes, wiring for said planes, and a foot lever for operating the same; Fig. 16ª is a view similar to Fig. 16 illustrating the wiring and two foot levers for operating the steering planes independently of each other; and Fig. 17 is a diagrammatical outline view in perspective of the machine in flight, illustrating the fundamental principles of its construction.

Referring by numerals to the accompanying drawings: 1 indicates the casing of the body, made out of any suitable material, such as sheet aluminum, which is curved almost circular in cross section. The for-

ward or front end of the casing is gradually curved to approximately the shape of the end of an egg and the lower surface is curved in approximately the arc of a circle. This casing is supported or built around any suitable framework, and in the construction shown a portion of the framework comprises L-shaped bands 2, spaced apart, passing transversely around the inside of the casing, and channel-shaped members passing longitudinally of the casing and at approximate right angles to the bands 2.

The casing 1 is provided with an opening 3 for the entrance and exit of the operator, and in front of this opening 3 a hood or shield 4 is formed or located, which has a curved front portion, and projects above the top edge of the opening 3.

5 indicates a motor, of any suitable construction or type, located within the casing 1, which motor is supported and mounted within said casing on any suitable supporting members, not shown.

7 indicates a propeller, of any desired form of construction.

8 indicates a tube, which passes transversely across the top of the casing 1 and above said casing, and projects an equal distance on each side of the vertical central line thereof, and has its terminal portions 9 curved downwardly, which terminal portions are united or secured in any suitable manner to a similar tubular member 10, which extends transversely below the casing, and has its terminal portions 11 curved upwardly, as illustrated in Fig. 2. The curved terminal portions 9 and 11 are connected or united in any suitable mechanical manner. The tube 8, located above the casing, and the tube 10, located below the casing, are connected at certain distances apart throughout their lengths, by means of tubular members 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22. The ends of these tubular members 12 to 22 inclusive are connected to the tubular members 8 and 10 in any suitable manner, as by being brazed together, or otherwise. In cross section the tubular members 8 and 10, and 12 to 22 inclusive, should be such as to offer the least resistance to the air.

Passing transversely through the casing 1 and in the rear of the tubes 8 and 10 is a tube 23. The terminal portions of this tube 23 are curved, as at 24, and the ends thereof are secured in any suitable manner at the points of intersection or joining of the tubular members 8 and 10 (see Fig. 3 for illustration). On each side of the casing 1 this tube 23 is curved upwardly, corresponding approximately with the longitudinal curvature of the planes of the machine. The tube 23, passing through the casing 1 of the machine and the tube 8, passing above and across the casing, are connected together at suitable distances apart on each side of the casing 1, by means of tubes 25, 26, 27, 28 and 29. On the opposite side of the casing 1 similar tubes are employed for connecting the tube 23 to the tube 8.

The construction of the framework on each side of the casing 1 is identical.

The tube 10, lying below the body or casing 1, is connected with the tube 23 by a series of tubular members 30, which connect the tube 23 and the tube 10 throughout their lengths at the points of intersection of the tubes 12 to 22 inclusive, with the tube 10. It will thus be seen that the framework heretofore described, projecting on each side of the casing 1, is triangular in cross section, as illustrated in Figs. 1 and 7, and in this framework the planes of the machine are mounted. This triangular framework is securely fastened to the framework on the inside of the casing 1 in any suitable mechanical manner, so that it will be substantially secured to said framework and cannot be moved or distorted relative to the casing 1.

It will be seen by reference to Fig. 5 that the central tubular member 17 is cut away about centrally of its length, leaving two tubular branches, 31 and 32, the tubular branch 31 projecting downwardly within the casing 1 from the tube 8, and the tubular member 32 projecting upwardly within the casing from the tube 10. These tubular branches 31 and 32 are secured in any suitable manner to the framework on the inside of the casing 1. The lower end of the tubular branch 31 has its walls perforated with a series of perforations (see Fig. 10 for illustration), through which pass the wires leading to the planes. Likewise, the upper end of branch 32 has perforations in its wall, through which the wires secured to the planes pass.

My machine is provided with two planes which are identical in construction and operation. These planes are pivotally secured to the framework on the inside of the casing 1 and are each set at an angle of incidence of approximately 13½° to the horizontal. The angle of incidence is always fixed or constant. The center of support of each plane may be shifted by lowering and elevating the planes, and the supporting area or force of each plane may be varied at the will of the operator. In other words, the supporting surface or force may be increased or decreased at the will of the operator, so that during ascent, descent or varied stability the plane may be given the maximum supporting surface or force. When flying in a straight line, the supporting surface may be decreased, thus reducing the friction of the air on the planes. In the construction shown (each plane being identical in construction—I will describe only one) the plane comprises a rigid portion 33, which

is constructed of a suitable framework covered with cloth or other suitable fabric. Secured along the rear margin of the rigid portion 33 of the plane is a flexible portion 34, and secured along the end margin of the rigid portion 33 is a flexible portion 35. The flexible portions 34 and 35 are continuous along the rear margin and the end of the plane. Adjacent to where the plane is pivotally connected to the body, a portion of the rigid portion 33 and the flexible portion 34 is cut away, forming an opening 35^a. The flexible portions 34 and 35 may be constructed out of any suitable material, and are designed to bend with the operation of the rigid portion 33. The rigid portion 33 is provided with two hinged members, 36, which are secured to the L-shaped bands 2 of the framework by means of pivot pins 37. The planes are capable of being swung upwardly and downwardly on these pivots, and are supported and operated by the mechanism hereinafter described. The inner or forward margin of the flexible portion 34 of the plane is secured to the rear margin of the rigid portion 33 in any suitable and mechanical manner, and the outer margin of the flexible portion 34 is secured to the tubular member 23 in any suitable manner; likewise, the flexible end margin 35 is secured to the tube 23 and the end of the rigid portion 33. The rigid portion 33 of the plane is curved upwardly and also has a transverse curvature from front to rear, as illustrated in Figs. 2, 5 and 7. When the plane is down to its lowest position, the flexible portion 34 is curved upwardly and rearwardly, and the plane in transverse section would have substantially the transverse curvature from front to rear illustrated in Figs. 1 and 7. When the rigid portion of the plane 33 is elevated to give the plane its maximum support, the rear flexible margin 34 is straightened out, and the plane would have substantially the transverse curvature illustrated in dotted lines in Fig. 7, and its curvature longitudinally would be substantially as illustrated in dotted lines in Fig. 5. When the plane is down, the flexible end margin 35 would have substantially the curvature illustrated in Figs. 2 and 5. The plane is practically located in the triangular framework heretofore described, the tubes 12 to 22 inclusive of the framework passing through openings formed through the planes. The plane is provided with a longitudinal curved spar 35^b, which carries a metal band 36^a. The tubes connecting the tubes 8 and 10 which pass through the planes are provided with slots 37^b, and mounted in the slots 37^b and in the slots 37^a formed in the band 36^a are pins 38, to which pins the wires which support and move the planes are secured. It will be observed by referring to Fig. 7^a that this construction permits the planes to be elevated upwardly and downwardly on the tubes without binding, as the pins 38 can move upwardly and downwardly in the slots 37^b and can move or shift laterally in the slots 37^a. Each opening through the plane—that is, where the tubes pass through the plane—is provided with a connection as described and illustrated in Fig. 7^a.

As shown, I have illustrated only one row or set of tubular members passing through the planes a short distance back from the front edge of the plane, but if desired, an additional row of tubular members may be passed through the plane along the rear margin thereof. In such case, the tubes would pass through the fixed portion 33 of the plane in proximity to its rear margin.

As heretofore stated, there are two planes, one on each side of the machine, which are identical in construction and mode of operation and are operated simultaneously; that is to say, they are both operated upwardly for maximum support, whereby the center of support of each plane is moved outwardly from the casing, and they are moved downwardly to decrease the support. In other words, the supporting surface, force or power may be gradually varied and the center of support of each plane shifted inwardly and outwardly by the simultaneous operation of the planes, but the angle of incidence remains fixed and constant.

The machine may be adjusted or curved so that its longitudinal central line or axis describes the arc of a circle, and when so adjusted the supporting planes may be swung upward to give maximum support to the machine.

The entire body portion of the machine from the casing 1 rearwardly is flexible and made up of a series of tubular sections 39, 40, 41, 42 and 43 (see Fig. 8 for illustration). Each of these sections, which are made out of any suitable material and covered with cloth or any suitable fabric, is movable relatively to every other, and the section 39 is movable relatively to the casing 1. As heretofore stated, by such a construction, the entire body of the machine longitudinally, that is to say, from the propeller shaft to the end of the machine, may be curved or adjusted to lie in or coincide with the arc of a circle, as illustrated in Fig. 17.

Projecting laterally from the sections 40, 41, 42 and 43 are fins or balancing planes 44 and 45^a. These fins, 44 and 45^a, are arranged to curve upwardly with the upward curvature or adjustment of the sections 40, 41, 42 and 43, and to curve downwardly with the downward movement or adjustment of the same, the several planes on each side forming in effect a flexible plane which flexes with the body either upwardly or downwardly.

I will now proceed to describe the con-

struction of the body and tail of the machine backward from the casing 1.

The rear end of the casing 1 is provided on its inside with a bearing ring 43^a, and the forward end of section 39 is slightly contracted. The contracted portion of the section 39 is located in the ring or band 43^a of the casing 1.

The pivotal connection by means of which the section 39 is secured to the casing 1, section 40 secured to the section 39, section 41 secured to the section 40, and section 42 secured to the section 41, is illustrated in Fig. 9, which is an enlarged transverse section through the forward end of section 41 and the rear end of section 40, it being understood in this connection that in Fig. 8 the bearing rings passing around the ends of the section are not shown. The connection between the sections referred to, as above stated, is illustrated in Fig. 9, and consists of a tubular shaft 44^a passing through the ends of the sections diametrically. In fact, there are two tubular shafts, such as 44^a, the inner ends of which are spaced apart, and mounted on these tubes 44^a is a rotating sleeve 45. The rotating sleeve has fixed to it two pulleys, 46 and 47, and formed through the sleeve between the pulleys is an elongated or oblong opening 48. The pivotal connection between the forward end of the section 39 and the casing 1, the rear end of section 39 and the forward end of section 40, the rear end of section 40 and the forward end of section 41, and the rear end of section 41 and the forward end of section 42, are the same, as above described. The connection between the rear end of section 42 and the forward end of section 43 is an ordinary hollow shaft or tube 49, passing diametrically through the mentioned ends of said sections. By such connection between the sections, said sections are permitted to move upwardly and downwardly relative to each other, but do not permit of any lateral or side movement of the sections.

In Fig. 8 I have shown a longitudinal diametrical vertical section of a portion of the rear end of the casing, and the machine rearward of the casing, and I have shown one-half of the wiring and connections for adjusting the sections, and beginning with the last section 43, one end of the wire 48^a is secured to the top or front end of section 43 and then said wire is passed forwardly and around the rotating sleeve 45, and secured to said sleeve, and the free end thereof is passed backwardly and secured to the lower portion of the front end of section 43. It will be understood in this connection that both ends of two such wires are secured to the front end of the section 43 and intermediate of their ends they are secured to the rotating sleeve 45. Thus it will be seen that if the rotating sleeve 45 is turned or rotated to the left in Fig. 8, the section 43 will be pulled upwardly on its pivotal connection 49. If the sleeve 45 is rotated in the opposite direction, the section 43 will be depressed or lowered. The wiring connected to the forward ends of sections 42, 41, 40 and 39 is the same, and, as heretofore stated, the pivotal connections between said sections and section 39 with casing 1 are the same. In order to rotate the sleeve 45 at the connection between the forward end of section 42 and the rear end of section 41, two wires are placed over the pulleys 46 and 47, and their free ends passed through the elongated opening 48 in the rotating sleeve 45, and carried through the openings formed in all the rotating sleeves in advance of it, and then carried forward and connected to one end of the sprocket chain 103 (see Fig. 14). The other ends of said wires are connected to the opposite end of said sprocket chain. Similar wires are located on the pulleys at the connection between the forward end of section 41 and the rear end of section 40, the forward end of section 40 and the rear end of section 39, and the forward end of section 39 with the casing 1. The wires are brought forward, and one of the free ends of each is connected to one end of a sprocket chain 103^a, and the opposite end to the other end of said sprocket chain. The wiring for these sections, 39 to 43 inclusive, is illustrated in Figs. 8, 11 and 14. By pulling one end of the wiring passed over the pulleys 46 and 47, the sections 39, 40, 41, 42 and 43 may be gradually curved or adjusted upwardly, as illustrated in Figs. 8 and 17.

The sections 42 and 43 are capable of independent downward movement or adjustment relative to sections 39 to 41 inclusive, as illustrated by dotted lines in Fig. 8; or these two sections, 42 and 43, may be moved or adjusted upwardly simultaneously with the upward movement or adjustment of sections 39 to 41 inclusive. In other words, all the sections, 39 to 43 inclusive, may be simultaneously moved or adjusted upwardly or downwardly, and the sections 42 and 43 may be adjusted independently of the sections 39 to 41 inclusive. By such an arrangement, the machine may be adjusted upwardly to form the arc of a circle, or the two sections 42 and 43 may be adjusted downwardly; or the machine from casing 1 to section 43 may be adjusted in approximately an S-shaped outline. This S-shaped outline is effected by first adjusting all the sections upwardly and then adjusting the sections 42 and 43 downwardly, without adjusting the other sections, 39 to 41 inclusive. The independent adjustment of sections 42 and 43 is controlled by a sprocket wheel 79 (see Fig. 14), which may

be operated simultaneously with the sprocket wheel 62, or it may be operated independently.

In Fig. 14 I have shown a top plan view, and in Fig. 5 a front elevation of the mechanism for operating the wiring secured to the planes and the wiring of the sections 39 to 43 inclusive. Fig. 14 illustrates one-half of the mechanism for operating the planes and said sections. Suitably mounted in the framework within the casing 1 are two horizontally disposed shafts 50 and 51, the shaft 50 being mounted in front of the shaft 51. Keyed to the shaft 50 is a sprocket wheel 52, and a cone pulley 53. There are two cone pulleys, such as 53, on the shaft 50, one of which controls the wiring for one of the planes on one side of the machine, and the other controls the wiring for the plane on the opposite side of the machine. In the construction shown, the wires which support and operate each plane are attached to the plane at five points longitudinally of its length. The wiring for each plane is concealed in the tubular members forming the framework. By such a construction, the wires offer no resistance.

The wiring for each plane is the same, and is as follows, (reference being had to Figs. 5, 6 and 7[a]): The wire is attached to the pin 38, passed up through the tube 18 and over the pulley 54, over the pulley 55, down through the branch 31 and out through a small hole in the side of this tubular branch, and placed in the groove 56 of the cone pulley 53. The wire is wrapped once around said pulley and secured thereto, as illustrated in Fig. 15, brought down through a hole in branch 32 and over a pulley located at the intersection of said branch with the tube 10, passed through tube 10 to the left (Fig. 5) and up through the tube 18 and secured to the pin 38. In other words, one end of the wire which is secured to the pin 38 where the tube 18 passes through the plane, is passed through the tubing and over the cone pulley 53 in the groove 56 thereof, and the opposite end is carried through the tubing and secured to the same pin 38. In the construction shown there are four such wires for supporting and operating each plane at four points, namely, where the tubes 18, 19, 21 and 22 pass through the plane, these wires being located respectively in the grooves 56, 57, 58 and 59 of the cone pulley 53. At the center of support of the plane, that is, where the tube 20 passes through the plane, a similar wire is used, but one end of this wire, instead of passing around the cone pulley 53 is attached to a rack 60 (see Fig. 10). In other words, at this point there is a wire, one end of which is secured to the pin 38, led through the tube and its opposite end secured to one end of the rack 60, and leading from the lower end of said rack 60 is a similar wire, which passes downwardly and through the tube 10, and passes up through the tube 20 and is secured to the pin 38. In other words, as shown, five wires are employed to support and operate each plane, four of said wires being operated by the cone pulley 53 and the other wire being operated by the rack 60. This rack 60 is mounted on a tube 60[a], and is operated upwardly and downwardly by means of the segment of a gear wheel 61 mounted on the shaft 50. In other words, the rotation of the shaft 50 actuates the cone pulley 53 and the rack 60.

Mounted on the stationary shaft 51 is a double sprocket wheel 62, and the sprocket wheel 52 mounted on the rotating shaft 50 has a sprocket chain 63, passing over the double sprocket wheel 62. The segment of the gear wheel 61 is mounted on the rotating shaft 50, as stated, and secured to this segment of the gear wheel 61 is a heavy coil spring 64, one end of said heavy coil spring 64 being secured to the rod 65, which rod is connected to a rod 66 by means of an internal screw threaded sleeve 67. The rod 66 is secured to the framework on the inside of the casing 1. By turning the internally screw threaded sleeve 67 the tension on the spring 64 may be varied. The operating levers are mounted on the stationary shaft 51, as shown in Figs. 5, 13, and 14. The operating lever 68 is keyed on the hub 70 of the double sprocket wheel 62 by means of a key 71. By operating the lever 68, the double sprocket wheel 62 is rotated on the stationary shaft 51. Keyed to the stationary shaft 51 are two ratchet wheels 72 and 73, the teeth of which point in opposite directions, and adapted to engage with the ratchet wheel 72 is a spring held pawl 74, and adapted to engage with the ratchet wheel 73 is a spring held pawl 75. The spring held pawls 74 and 75 are disengaged by pressing the member 76 toward the handle bar 77. (See Fig. 11.) The lever 69 is mounted on or connected to the hub 78 of the sprocket wheel 79 by means of a key 80. By operating the lever 69, the sprocket wheel 79 is rotated on the stationary shaft 51. The lever 69 is detachably secured to the lever 68 by means of a spring held button 81 (see Figs. 11 and 12). The stem of the button passes through the lever 69, and when engaged its free end is seated in the opening 82 of the lever 68, it being held seated in said opening by means of a spring 83 lying on the face of lever 69, and on the shoulder 84 of the stem of the button. The stem of the button 81 is released from the opening 82 by means of the lever 85, carrying on its lower end a wedge-shaped member 86. By pulling the lever 85 toward the handle 87 of the lever 69, the wedge-shaped

member 86 will release the end of the stem from the opening 82, thus permitting the lever 69 to be operated independently of the lever 68. By this arrangement, the two levers 68 and 69 may be operated together, or the lever 69 may be operated independently of the lever 68. When the two levers, 68 and 69 are locked together, by operating the lever 68 the double sprocket wheel 62 and the sprocket wheel 79 are rotated together. If said levers are disengaged by pressing on the lever 85, the lever 69, and consequently the sprocket wheel 79, may be operated independently of the lever 68. The wiring which controls sections 43 and 42 of the tail or rear body portion of the machine is led to the sprocket chain 103 mounted on the sprocket wheel 79, and when it is desired to adjust these two sections, 42 and 43, independently of the sections 41, 40 and 39, the lever 69 is disengaged from the lever 68 and operated independently.

From the foregoing description, it will be seen that when the levers 68 and 69 are locked together and pushed forwardly by the operator, the double sprocket wheel 62 and the single sprocket wheel 79, and the sprocket wheel 52, carried by the rotating shaft 50, and the sheaved cone pulley 53, will be rotated forwardly. This forward movement of the levers will pull downwardly over the sheaved cone pulley 53 the wires leading to the planes, and consequently elevate the rigid portion 33 of the plane, as desired, and simultaneously with the forward rotation of the sprocket wheel 52 and sheaved cone pulley 53, the double sprocket wheel 62 and the single sprocket wheel 79, and the sprocket chain 103ª carried by the double sprocket wheel 62, and the sprocket chain 103 carried by the single sprocket wheel 79, will move forwardly and pull forwardly the wiring which adjusts the sections 39, 40, 41, 42 and 43. By pushing forward the levers 68 and 69, as heretofore stated, the rigid portions 33 of the planes are elevated and the sections 39 to 43 inclusive are moved or adjusted upwardly. When it is desired to give the machine the maximum support, the rigid portions of the planes are elevated and the sections 39 to 43 inclusive are simultaneously adjusted or curved upwardly. It will be understood in this connection that when the levers 68 and 69 are pushed forwardly, the segment of the gear wheel 61 is rotated to the left, as illustrated in Fig. 10, and the rack 60 is moved downwardly and will consequently pull the wire which leads from the top end of said rack to the center of support of the plane; that is, where the tube 20 passes through the plane. The sheaved cone pulley 53 and the rack 60 operate the wiring for the planes. The double sprocket wheel 62 and the single sprocket wheel 79 operate the wires for the tail or rear body sections 39 to 43 inclusive. If it is desired to lower the rigid portions 33 of the planes and straighten out the sections 39 to 43 inclusive, the operator pulls the lever 68 with the lever 69 locked thereto, toward him. This operation is performed when it is desired to decrease the support of the planes. By such construction it will be seen that the increase and decrease of the supporting area, force or power of the planes and the adjustment of the sections 39 to 43 inclusive, are under the positive control of the operator, and practically by means of one lever.

In Fig. 4 I have illustrated the construction by means of which, when the sections 40 to 43 inclusive, are curved or adjusted upwardly, the fins or balancing planes 44 and 45ª are curved upwardly. The fins or balancing planes 44 and 45ª are carried by the sections 40 to 43 inclusive, and are constructed by the use of flexible ribs 87ª passing through the tubular pivotal connection between the sections, and secured to the ends thereof is a wire 87ᵇ, which wire is brought through a hole 87ᶜ in the end of section 41, and connected to the edge of the end of section 42. There is a similar connection below and on the opposite side of the sections. When the section 42 is moved upwardly, the wire 87ᵇ will be pulled downwardly in the middle, or shortened, which shortening of the wire 87ᵇ will pull upwardly the ends of the flexible rib 87ª, and consequently curve upwardly the fins or balancing planes 44 and 45ª. If the section 42 is moved downwardly, the wire beneath the section will be shortened, and the ends of the flexible rib 87ª will be pulled downwardly, consequently the fins 44 and 45ª will be curved downwardly. By such a construction, when the sections 39 to 43 inclusive are moved or adjusted upwardly, the fins 44 and 45ª will be slightly curved upwardly, and when the sections 42 and 43 are curved downwardly, said fins will be slightly curved downwardly.

90 indicates horizontal steering planes, and in Fig. 16 I have shown the wiring and foot lever for operating said steering planes. These steering planes are loosely mounted on the tube 23 of the triangular framework of the planes, and the wiring is fed through the tubular framework down through the branch 31, and is connected to the foot lever 91 which is pivotally secured to the framework on the inside of casing 1. These horizontal steering planes are positively supported in horizontal position by the wiring, as illustrated in Fig. 16, and are operated by the foot of the operator acting on the pivoted foot lever 91. When one end of the foot lever 91 is pressed downwardly to the right, as in Fig. 16, the horizontal steering plane 90 on the right will be depressed, and the horizontal steering plane on the left will

be elevated an equal distance. If the pedal or foot lever is pressed down on the left, the movement of the horizontal steering planes will be reversed. It will thus be seen that the horizontal steering planes are positively controlled and when one is pulled downwardly the opposite one is elevated an equal distance, and vice versa. If it is desired to operate the steering planes 90 upwardly or downwardly independently of each other two foot levers, such as 91, are employed and the planes wired separately to each foot lever, as illustrated in Fig. 16ª.

The machine is supported by three wheels. The wheel 92 is mounted in the U-shaped frame 95, which is secured and yieldingly mounted on section 39, which U-shaped frame is braced by a rod 96. Each of the wheels 93 and 94 is mounted or carried on a yielding framework 97, and lying intermediate of these wheels is a skid or slide 98, one end of which is slidingly and pivotally mounted on a rod carried by the triangular framework, and secured to its forward end is a rod 100, seated in a tube or cylinder 101, provided with an opening for the admission of air when the rod or plunger 100 is moved downwardly. When the rod 100 is moved downwardly, air is sucked in through the opening in the tube or cylinder 101, which forms an air cushion for the rod or plunger 100 when the same is pushed upwardly. Thus it will be seen that the machine is yieldingly supported by springs and air cushions to minimize the shock when the machine alights on the ground.

The operation of my improved flying machine is as follows: The operator or aviator takes his seat in the machine through the opening 3 and the motor 5 is started, and when the motor has reached sufficient speed the operator pushes forward the lever 68 (it being understood in this connection that the lever 69 is locked to the lever 68), and the forward movement of said lever will elevate the rigid portion 33 of the planes and straighten out the flexible rear margins 34 and 35 thereof. With this operation, the sections 39 to 43 inclusive will be curved upwardly. This operation will give the machine the maximum support, which is advantageous in rising, and the longitudinal curvature of the machine will cause the machine to ascend upwardly in a curved line of flight. When the rigid portions of the side planes are elevated, and the tail or rear section of the body portion is curved, the longitudinal axis of the machine from the tip of the tail to the propeller shaft, will describe, as it were, as illustrated in Fig. 17, an arc of a circle, and in ascending the line of flight will describe almost an arc of a geometrical circle of varying radii, depending on the adjustment of the machine. When the operator has reached the desired altitude, the rigid portions of the planes may be depressed or lowered, and the tail or rear body sections 39 to 43 inclusive are straightened out, which is accomplished by the operator or aviator pulling toward him the lever 68. By operating the lever 68, which actuates the sheaved cone pulley 53 and the rack 60, on which is mounted or secured the wiring for supporting, elevating and depressing the planes, the supporting area, force or power of the planes may be increased or decreased at the will of the operator. Thus it will be seen that the supporting area, force or power of the planes will be decreased with the lowering of the rigid portions 33, and by elevating said rigid portions the supporting area, force or power will be increased, and assuming the speed of the machine to be constant with the increase of supporting area, the resistance will be increased, and with the decrease of the supporting area the resistance will be lessened, and it will be understood in this connection that the lowering and elevating of the rigid portions 33 of the planes does not change the angle of incidence—the angle of incidence being always fixed or constant. It will be further understood that with the elevation of the rigid portions 33 of the planes, the center of support of each plane moves outwardly from the body of the machine.

It is apparent from the description heretofore set forth that the support of the machine may be gradually varied and controlled at the will of the operator, and that when the center of support of each plane is moved outwardly by the upward movement of the plane, the supporting area is increased. It is believed that with the forward and rearward operation of the levers 68 and 69, when locked together, and the consequent elevation of the rigid portion 33 of the planes, and the upward curvature of the tail or rear body sections 39 to 43 inclusive, and the lowering of these rigid portions and the straightening out of the sections, the machine will travel forward in an undulating line of flight if the motor should stop, because if we assume the machine supported in the air by its maximum support—that is, when the rigid portions of the planes are elevated—by depressing the rigid portions the support will be decreased, the friction lessened, and the machine will by its own momentum go forwardly in a downwardly inclined curve.

As heretofore stated, the fins or balancing planes 44 and 45ª curve upwardly with the upward movement or adjustment of the tail sections 39 to 43 inclusive, and curve downwardly with the downward movement or adjustment of the sections 42 and 43. If it is desired to change the direction of flight laterally, the operator elevates the rigid portions of the planes and curves

upwardly the tail sections 39 to 43 inclusive. This adjustment will cause the machine to first move in an arc of a vertical circle, and then by manipulation of the horizontal steering plane 90 by means of the pivotal foot lever 91, the direction of flight is changed from a vertical circle to an oblique circle, corresponding, of course, as to which side of the pedal 91 is depressed. It will thus be seen that the direction of flight is changed from the arc of a vertical circle by means of the horizontal steering planes 90 to the arc of an oblique circle or horizontal circle. It will thus be seen, from the foregoing description, that the machine, when it rises from the ground, ascends in the arc of a circle; in flight it travels in the arc of a circle; in changing the direction of flight it travels in the arc of a circle; and in descending to the earth it travels in the arc of a circle. Of course it will be understood in this connection that the arcs of circles described in rising, in flight, in changing the direction of flight and in descending, vary, depending on the adjustment of the machine.

The practical advantages arising from my invention in a general way, are as follows: In arising from the ground, the pushing forward of the lever 68 adjusts the machine so that its longitudinal, central line describes the arc of a circle, and the machine is adjusted for its maximum support, thus enabling the operator to rise more quickly. After rising from the ground, the machine may be adjusted to almost a horizontal plane for almost straight flight. Should the longitudinal or lateral stability of the machine be displaced, it can be readily restored at the will of the operator by adjusting the machine back to its curved form. By being able to curve the machine, the changing of the direction of flight is rendered more safe. By being able to gradually curve the machine and vary the support in descending to alight, the gliding may be more uniformly and easily controlled. In curved line flight, the relations between the center of support and the center of weights always remain the same, so that if the machine is inclined to the horizontal, the weights are not displaced from the line joining the center of support.

The principle of construction of my machine is diagrammatically illustrated approximately in Fig. 17, being a perspective view of the machine in outline in flight. Referring to this illustration, the point *f* indicates the sum or center of the weights of the entire machine. The line *d'—c'* indicates the machine in a straight line, having the center of the sum of the weights at *f*. *t* indicates a line struck from *f* perpendicular to *d'—c'*. *a—b* is a line connecting the center of the sum of the supports of the planes on each side of the machine which are equal. This line *a—b* passes through or intersects the line *f—t* at the point *o*, which point represents the total sum of the supports in the adjustment as illustrated, and which is perpendicular to the line *f—t*. The point *o* is not fixed on the line *f—t* but is variable along the line *f—t*, depending on the arc made by the machine when curved and the consequential change in position of the center *f* of the sum of the weights. G—*f*—H indicates an arc of an assumed circle where *f* again indicates, for the purposes of this description, the center of the sum of the weights, having its center at some point on the line *f—t* extended. The machine is curved to coincide with the arc G—*f*—H, and it takes the position *d—f—c* along the same arc. At the point *c* the line *s'* is drawn perpendicular to the arc G—*f*—H, which cuts or intersects the extended line *f—t* at the point *s*, and determines the geometrical center of the circle of which G—*f*—H is an arc. The arc *d—f—c* has a chord *d—c*. This chord *d—c* passes through the radius *f—s* at the point *o'*. The point *o'* of intersection is the lowest point that the sum of the supports can be raised when the machine describes the arc *d—f—c*. But the support can be raised along the radius; for example, to the point *o* on the chord *e—c*, or higher along the same radius, but not higher than that point where the chord becomes perpendicular to the radius *f—s*. If the support *o'* is originally set above the sum of the weights *f* when the machine is in a straight line *d'—f—c'*, then the sum of the supports will take a relative position above the point *o'* if the machine is curved, rising relatively, for example, to the point *o* on the radius *f—s*, and if the supports *o'* or *o* are set at *f* when the machine is in a straight line *d'—f—c'*, the support can be raised to the point *o*, but in all cases the center of supports *o* or *o'* is on the variable radius *f—s* and perpendicular to the sum of the weights *f* on the line *d'—f—c'*—it being understood that the angle of incidence of the planes never varies relative to the center of the sum of the weights, regardless of any adjustment of the machine.

In the diagrammatical illustration referred to, it will be understood, of course, that I have shown only one adjustment of the machine, and consequently one line, *a—b*, connecting the centers of support of each plane in such adjustment, wherein the center of support is set relatively above *f* when the machine occupies the position *d'—f—c'*. It will be appreciated that when the point *f* is shifted, due to the curving of the relatively heavy flexible tail portion, the point *o* will shift correspondingly although maintaining the described relation to the

point *f*. It is the structure by which this invariable relation of the points *o* and *f* is secured that is of importance and it is only by the employment of a weighted flexible tail and the flexing planes that the invention can be realized and the desired stability automatically maintained.

From the above description and the illustration referred to, it will be seen that the sum of the weights or the center of the sum of the weights of the machine always occupies a fixed relation to the center of the sum of the supports of the planes, regardless of the position of the machine relative to the horizontal or the adjustment of the machine.

By being able to curve the balancing planes or fins 44 and 45ª downwardly and to adjust or curve downwardly the sections 42 and 43 independently of sections 39 to 41 inclusive, the speed of the machine in descending may be checked, said fins acting, as it were, as a kind of brake.

I claim:

1. A flying machine, comprising a rigid body portion, a flexible rear body portion of substantial weight, a pair of supporting planes secured to and carried by said rigid body portion, and means for gradually flexing said flexible rear body portion during flight and maintaining it in a straight or curved form, whereby the center of the sum of the weights of the machine is maintained in the line which passes through the center of the sum of the supports, and stability is restored or maintained regardless of the adjustment of the machine or its inclination to the horizontal.

2. A flying machine, comprising a rigid body portion, a flexible rear body portion, a horizontal balancing plane disposed on each side of said flexible rear body portion and capable of relative angular movement therewith, a pair of supporting planes secured to and carried by the said rigid body portion, and means for curving the flexible rear body portion and maintaining the same in the desired curvature.

3. In a flying machine, a pair of supporting planes disposed at a dihedral angle and movable on axes running approximately parallel with the body of the machine, a flexible tail, means for elevating and lowering said supporting planes and simultaneously therewith adjusting said tail, to lie on or describe arcs of circles of different radii.

4. In a flying machine, a flexible body portion capable of being adjusted to arcs of different circles, a pivoted supporting plane, and means for simultaneously operating said supporting plane and said body portion for increasing or decreasing the supporting force of said supporting plane and adjusting said body portion in arcs of different circles.

5. In a flying machine, a movable supporting plane having a rigid portion curved longitudinally upwardly and downwardly and curved transversely upwardly and downwardly, and having secured along its rear margin a flexible portion and along its end margin a flexible portion, and means for elevating and lowering said rigid portion and straightening out said flexible portion, lowering said rigid portion and curving said flexible portion, whereby the supporting force of the plane may be increased and decreased at the will of the operator.

6. In a flying machine, a casing, a framework for said casing, planes pivotally carried by said framework, a sectional body portion, balancing planes carried by said sectional body portion, means for elevating said planes and simultaneously adjusting upwardly the sectional body portion and lowering said planes and straightening out said body portion, means for curving upwardly the balancing planes with the upward adjustment of the sectional body portion, and means for adjusting one or more of the sections of the sectional body portion independently of the remaining sections thereof.

7. A flying machine, comprising a framework, a casing inclosing said framework, a triangular tubular framework carried by said first mentioned framework, a pair of pivoted supporting planes mounted in said triangular tubular framework, each of said supporting planes provided along its rear margin and its end margin with a flexible portion, a sectional body portion, balancing planes carried by some of the sections of said flexible body portion, wiring for supporting, elevating and lowering the planes, wiring for adjusting the sections of the sectional body portion relative each other, and a lever for raising the planes simultaneously therewith, adjusting the sections of the flexible body portion relative each other, and a lever for adjusting two of the sections of the sectional body portion relative to the remaining sections.

8. In a flying machine, a supporting plane mounted on an axis running approximately parallel with the body of the machine and provided along its rear and end margin with a relatively movable transversely flexible portion, a rigid support for the margin of said flexible portion, and means for elevating and lowering said plane and maintaining the same in the desired adjustment, whereby the center of support of the plane is shifted and the supporting force thereof is varied.

9. In a flying machine, a supporting plane having a rigid portion normally cambered longitudinally and transversely, and provided along its rear and end margins with a relatively movable flexible portion and

having a rigid support for the margin of said flexible portion, in combination with means for elevating said plane and changing its center of support outwardly, and simultaneously therewith increasing the supporting force by the operation of the plane.

10. In a flying machine, a supporting plane having a rigid portion normally cambered longitudinally and transversely, the said supporting plane having affixed to its rear margin and its end a flexible portion, a support for the outer margin of the flexible portion, and means for lowering and elevating said rigid portion, whereby said margins curve upwardly with the lowering of the rigid portion and the supporting force is decreased, and with the upward movement of said rigid portion the flexible margin is curved downwardly in a direction with the normal camber of the rigid portion.

11. A flying machine, comprising a central framework and a casing therefor, a triangular framework carried by said central framework, a pivoted aeroplane carried on each side of said central framework and practically mounted in said triangular framework, a sectional rear body portion, a supporting shaft carried by said central framework, sprocket wheels mounted on said stationary shaft, a rotating shaft mounted in said central framework, a sprocket wheel and cone pulley mounted on said rotating shaft, a connection between said rotating and said stationary shafts, a pair of levers mounted on said stationary shaft, means for locking and unlocking said levers so that they may be operated together or independently, sprocket chains carried by sprocket wheels on the stationary shaft and flexible connections between said sprocket chains carried by the stationary shaft and the cone pulley carried by the rotating shaft and the planes and rear body sections.

12. A flying machine, comprising a central framework and a casing therefor, a triangular framework carried by said central framework and projecting on each side thereof an equal distance, a pivoted aeroplane carried on each side of said central framework and practically mounted in the said triangular framework by having a part of the framework pass through the aeroplane, a sectional rear body portion, a stationary shaft carried by said central framework, sprocket wheels mounted on said stationary shaft, a rotating shaft carried by said central framework, a sprocket wheel and cone pulley mounted on said rotating shaft, a flexible connection between said rotating and said stationary shafts, a pair of levers mounted on said stationary shaft, means for locking and unlocking said levers so that they may be operated together or independently, sprocket chains carried by the sprocket wheels on the stationary shaft and flexible connections between said sprocket chains carried by the stationary shaft and the cone pulley carried by the rotating shaft and the planes and the rear body sections, whereby, by the operation of said levers when locked together, the planes and sectional rear body portion may be simultaneously adjusted, and by the operation of one of said levers independently of the other, certain sections of the sectional rear body portion may be operated independently of the other sections thereof and the planes.

13. A flying machine, comprising a body portion, the major part of the longitudinal axis of which is capable of being flexed to lie on or describe arcs of circles of different radii to form a curved body, a pair of supporting planes, a series of balancing planes capable of being flexed with the body portion, and means for flexing said axis during flight and maintaining the same in straight or curved form.

14. A flying machine, comprising a rigid body portion, a casing therefor, a flexible rear body portion provided with a series of balancing planes capable of flexing therewith, a transversely disposed framework carried by said rigid body portion, a pair of supporting planes mounted practically within said framework, a suitable motor and propeller, and means for gradually flexing the flexible rear body portion, and maintaining the same in the desired adjustment during flight.

15. In a flying machine, a rigid body portion and a flexible rear body portion provided with a series of balancing planes capable of flexing therewith, a pair of supporting planes having a fixed angle of incidence carried by said rigid body portion and set at an angle to the horizontal, and means for lowering and elevating said planes simultaneously for varying the angle and increasing and decreasing the supporting force thereof.

16. In a flying machine, a supporting plane mounted to swing up and down on an axis disposed in a direction approximately parallel with the body of the machine, a flexible tail, means for elevating and lowering said supporting plane on said axis, and simultaneously therewith curving said tail, to lie on or describe arcs of circles of different radii.

17. In a flying machine, a supporting plane movable bodily up and down on an axis disposed in a direction approximately parallel with the body of the machine, a flexible tail, balancing planes carried by said tail, means for adjusting said plane with

a swinging movement upwardly and downwardly on said axis and simultaneously therewith curving said tail upwardly or downwardly, whereby the center of support of the plane is shifted outwardly and inwardly and simultaneously therewith the supporting force of the plane is varied.

18. In a flying machine, a flexible body portion capable of being adjusted to arcs of different circles, a supporting plane and means for simultaneously operating said supporting plane and said body portion for increasing or decreasing the supporting force of said supporting plane and adjusting said body portion to arcs of different circles.

19. In a flying machine, a flexible body portion, a pivoted aeroplane, a horizontal steering plane carried by said aeroplane, a pivoted foot lever and a flexible connection between said foot lever and said horizontal steering plane for supporting the steering plane normally in a horizontal position and operating the same upwardly and downwardly.

20. In a flying machine, provided with a suitable motor and propeller for lifting and propelling said machine, a supporting aeroplane, a flexible tail provided with a plane, means for curving said tail to different degrees of curvature, and simultaneously therewith changing the angular relation of the longitudinal axis (transverse to the longitudinal axis of the machine) of the supporting plane to the horizontal.

21. In a flying machine, a supporting aeroplane having a fixed angle of incidence and set on the machine at an angle to the horizontal and mounted on an axis disposed in a direction approximately parallel with the body of the machine, a flexible body portion, and means for gradually flexing the flexible body portion and simultaneously therewith changing the angular relation of the longitudinal axis (transverse to the longitudinal axis of the machine) of the supporting plane to the horizontal.

22. In a flying machine, a rigid body portion, supporting planes pivotally carried by said body portion and arranged at a dihedral angle to each other, a flexible rear body portion, balancing planes carried by said flexible rear body portion, and means for varying the angular relation of the supporting planes to the horizontal, and simultaneously therewith curving the rear body portion.

23. In a flying machine, provided with a suitable motor and propeller for lifting and propelling said machine, a flexible rear body portion capable of being adjusted so that its longitudinal central axis may assume a straight line or be curved so that said axis may assume or describe arcs of circles of different radii, supporting planes arranged at a dihedral angle, and means for gradually adjusting said rear body portion at the will of the operator and simultaneously therewith varying the angle of the supporting planes.

24. In a flying machine, supporting planes pivoted on axes running approximately parallel with the body of the machine, a flexible rear body portion capable of being curved or adjusted so that its longitudinal central axis may describe arcs of circles of different radii and provided with a series of balancing planes capable of flexing therewith, and means for curving or adjusting said rear body portion during the ascent, flight, or descent of the machine.

25. In a flying machine, having a body portion capable of being adjusted or curved so that its longitudinal central axis may lie on or describe arcs of circles of different radii, a suitable motor and propeller for lifting and propelling said machine, a supporting plane, and means for adjusting or curving said machine during ascent, flight or descent, and simultaneously therewith varying the angle of the supporting plane.

26. In a flying machine, having a suitable motor and propeller for lifting and propelling said machine, a supporting aeroplane arranged at an angle to the horizontal, a flexible tail provided with balancing planes and capable of being given a double reverse curvature, and means for varying the angle of the supporting plane and simultaneously therewith adjusting the flexible tail to a compound reverse curvature.

27. In a flying machine, a rigid body portion and a flexible body portion, a transversely disposed triangular framework carried by the rigid body portion, a supporting plane carried by the rigid body portion and set at an angle and on an axis running in a direction approximately parallel with the said rigid body portion, and means for varying the angle of the supporting plane without changing its angle of incidence, and simultaneously therewith adjusting the flexible body portion.

28. In a flying machine provided with a suitable motor and propeller for lifting and propelling said machine, a flexible body portion capable of being flexed so that its longitudinal central axis may assume a straight line or be curved to assume or describe arcs of circles of different radii and provided with a series of planes capable of flexing therewith, a supporting plane and means for uniformly flexing said flexible body portion during flight.

29. In a flying machine, a flexible body portion, a pair of supporting planes capable of having their supporting force increased without varying their superficial area, and

having a fixed angle of incidence and set at an angle to the horizontal, and means for gradually flexing the flexible body portion and simultaneously varying the angle of the supporting planes.

30. In a flying machine, a rigid body portion, a sectional body portion, the sections whereof are pivotally connected together, a supporting plane, an operating lever, flexible connections leading to the sections of the sectional body portion, and means for operating the flexible connections, whereby the sections may be adjusted relative to each other.

31. In a flying machine, a rigid body portion, a flexible body portion, the said flexible body portion being provided with oppositely disposed horizontal balancing planes, a supporting plane, a suitable motor located within the rigid body portion, a suitable propeller therefor, flexible connections attached to the flexible body portion at different points throughout its length, and means for operating said flexible connections whereby the axis of the flexible body portion may be adjusted to lie on or describe arcs of circles of different radii, or may be maintained in a straight line during flight.

32. In a flying machine, a flexible rear body portion of substantial weight, and means for adjusting and maintaining during flight the longitudinal axis of the flexible rear body portion in straight or curved form, whereby the center of gravity of the machine may be shifted during flight regardless of the adjustment of the machine or its inclination.

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

LEWIS GINTER YOUNG.

Witnesses:
ASHER GOLDEN,
ALEXANDER FORSTEIN.