C. RIELY.

AEROPLANE.

APPLICATION FILED MAY 22, 1915. RENEWED JAN. 13, 1916.

1,202,429.

Patented Oct. 24, 1916.

11 SHEETS—SHEET 1.

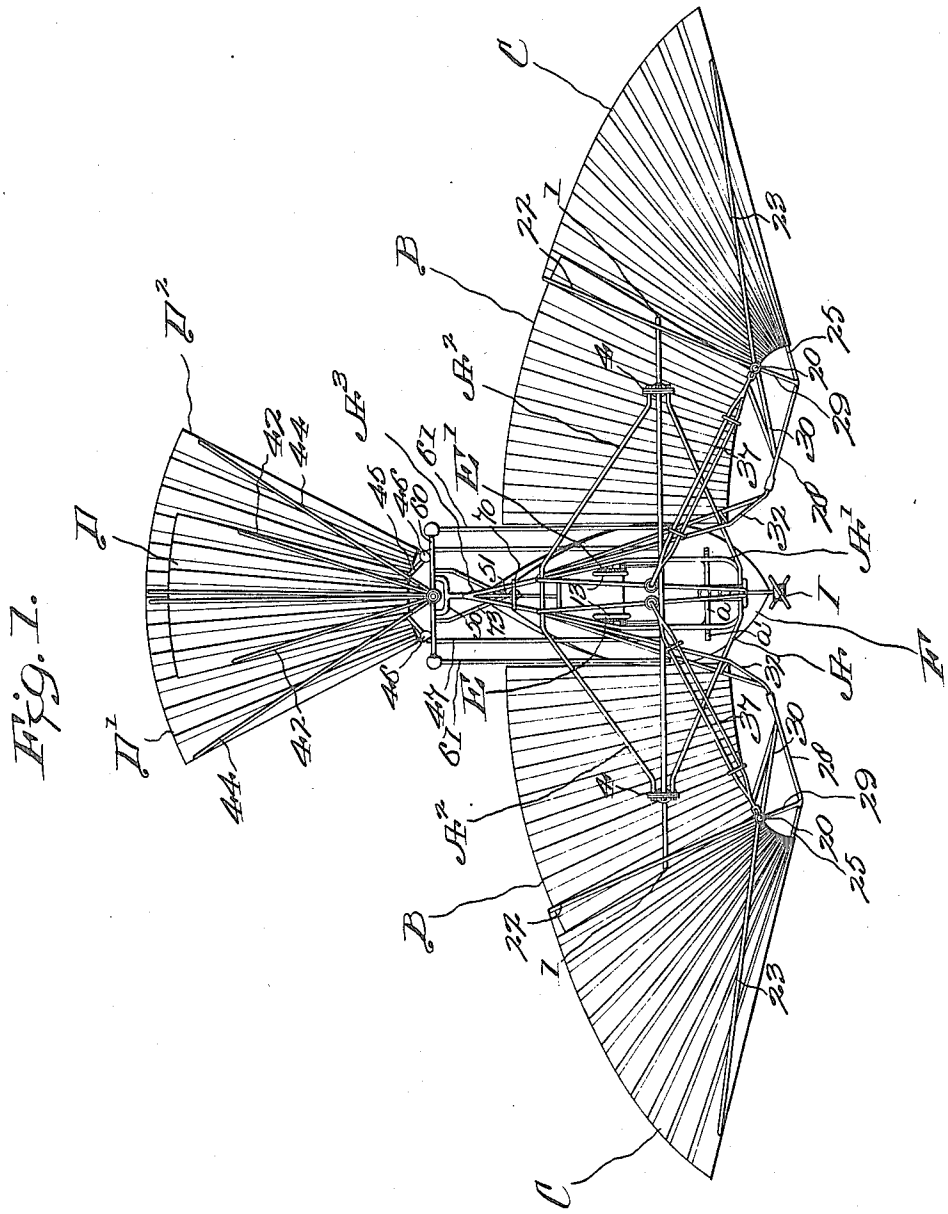


Fig. 1.

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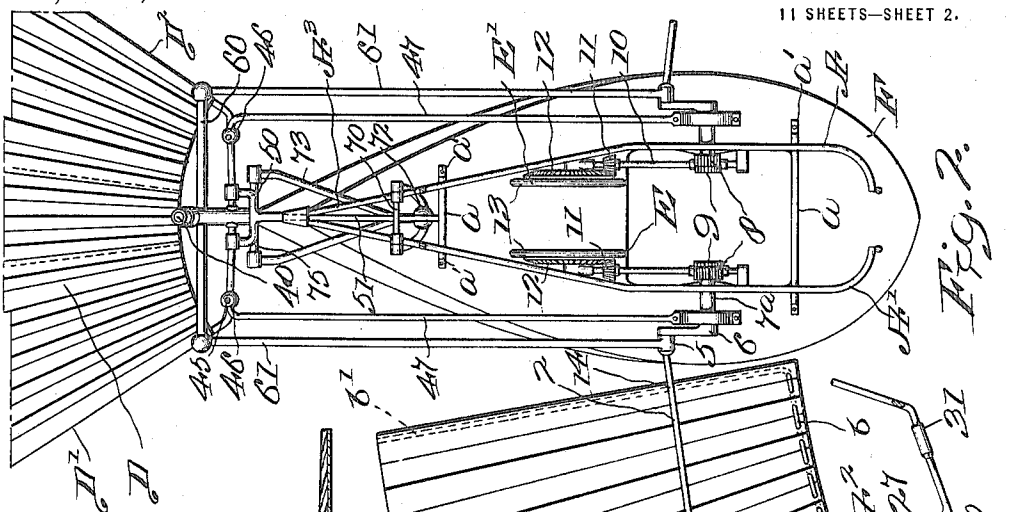


Fig. 2.

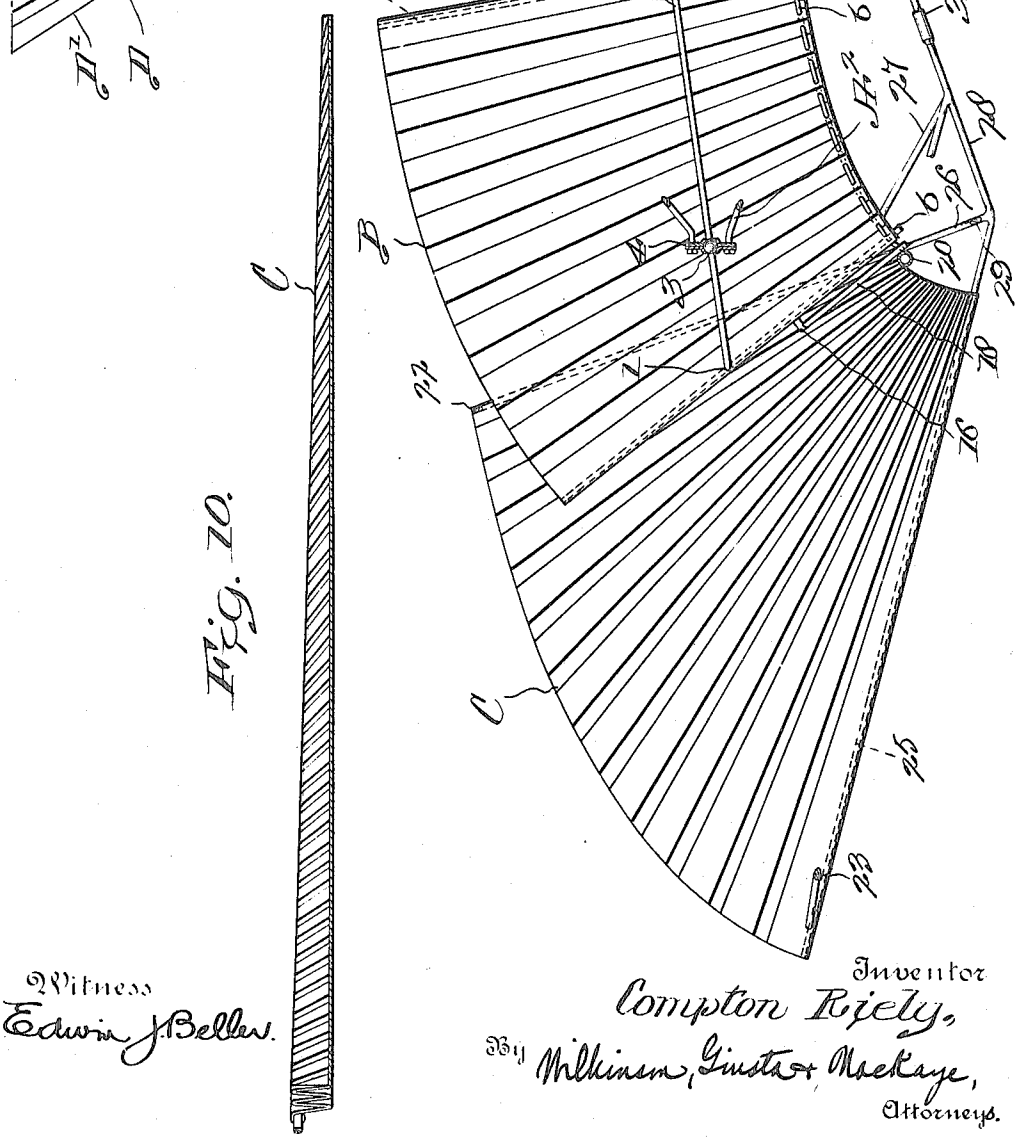


Fig. 10.

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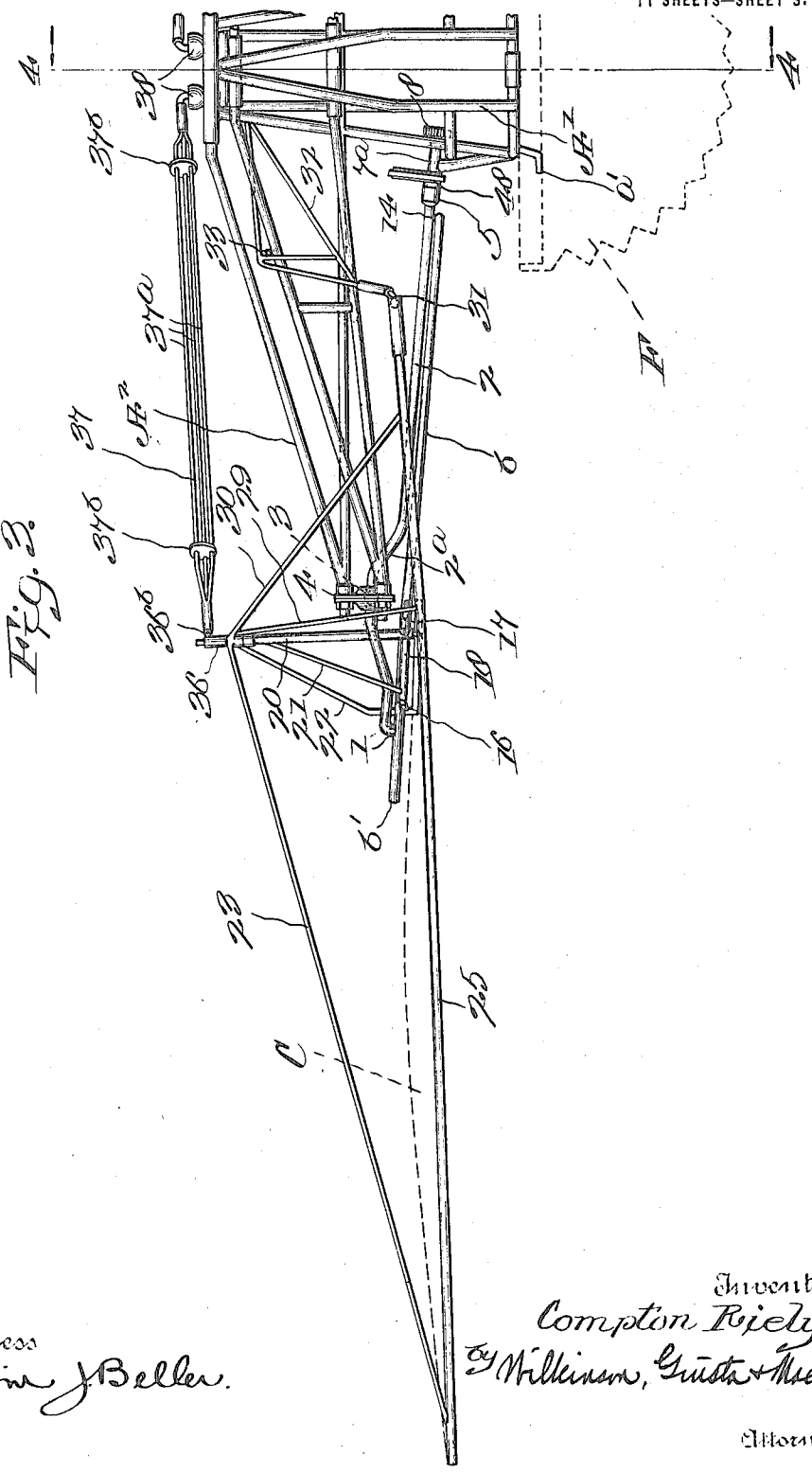


Fig. 2.

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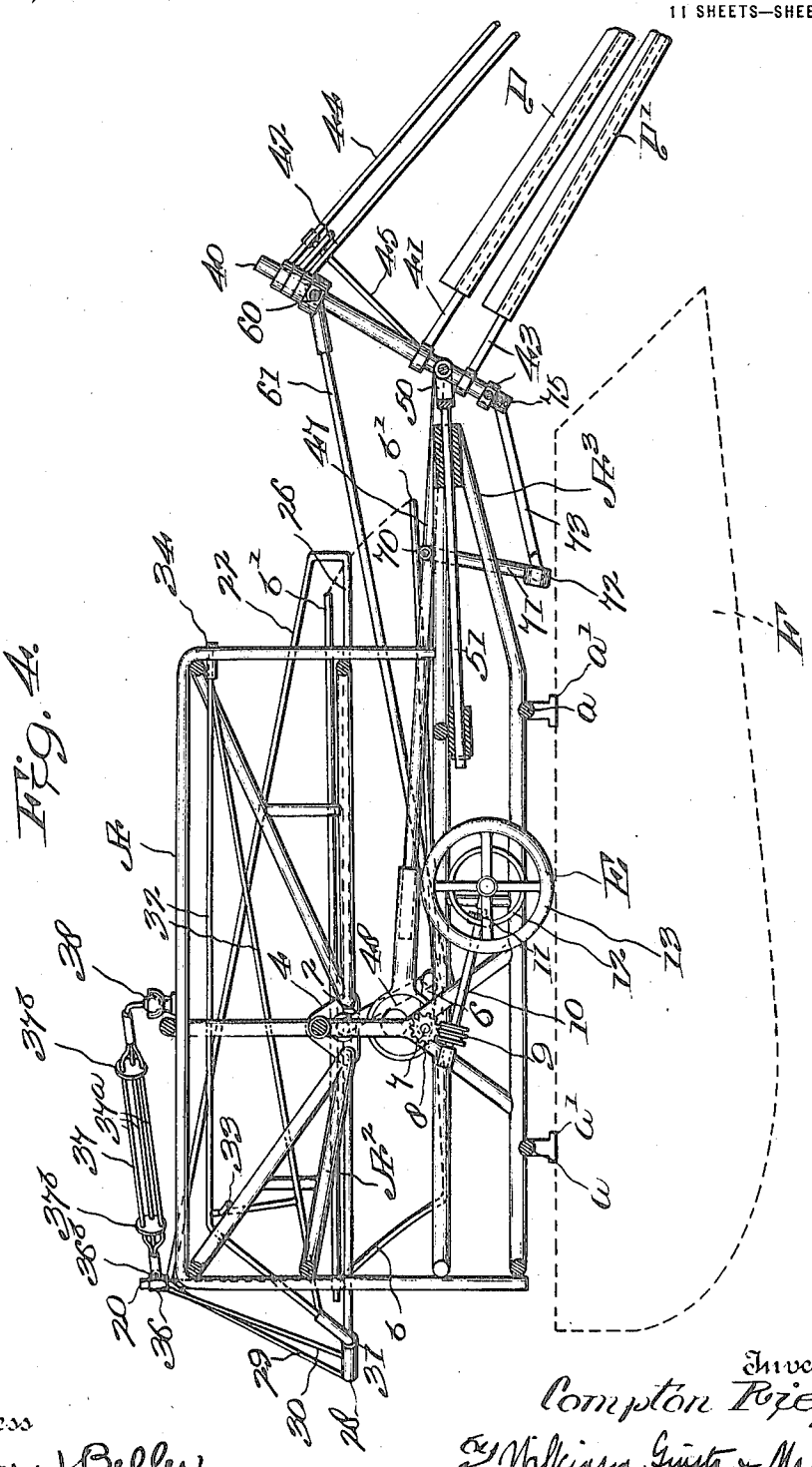


Fig. 4.

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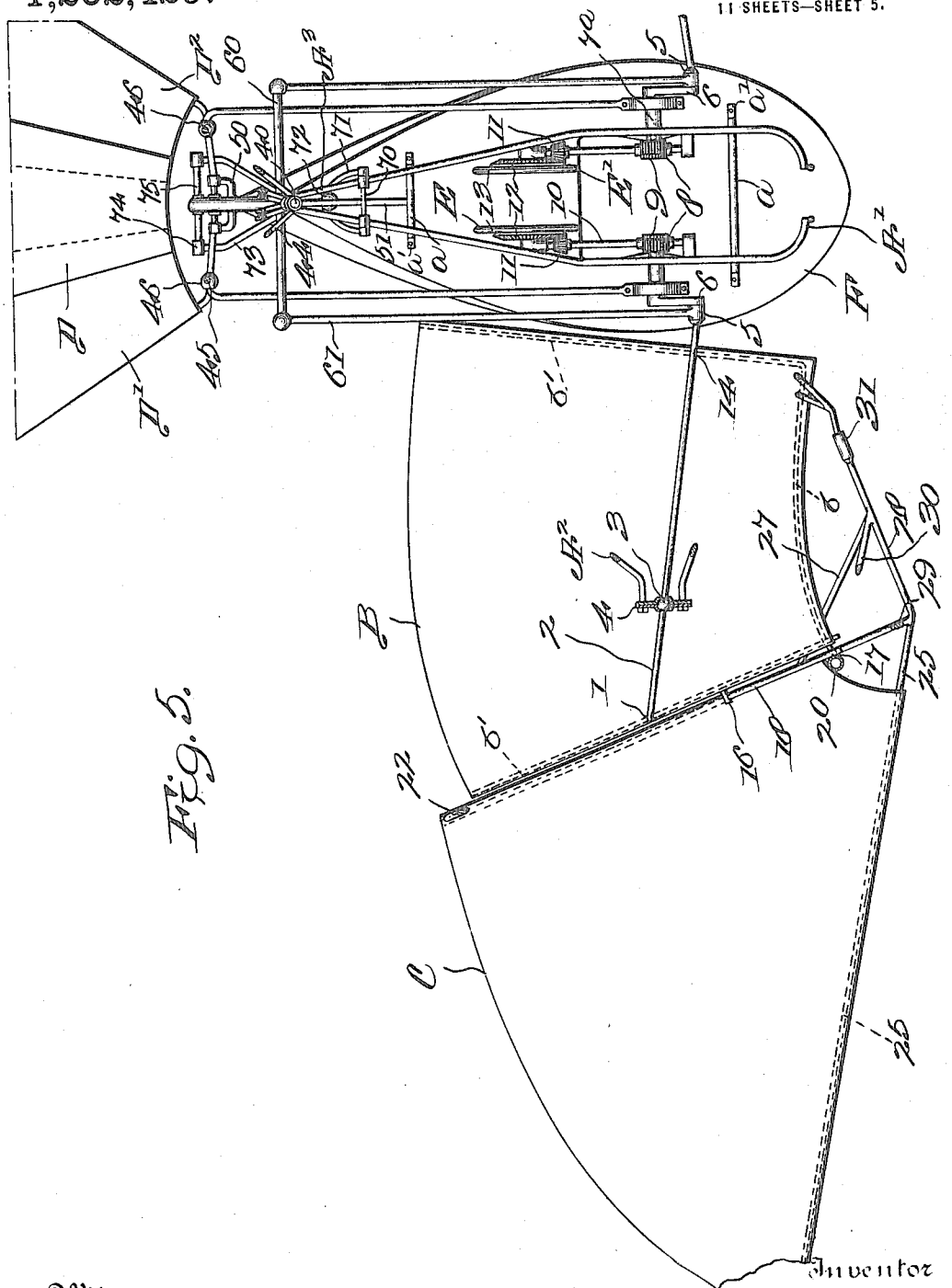


Fig. 5.

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11 SHEETS—SHEET 6.

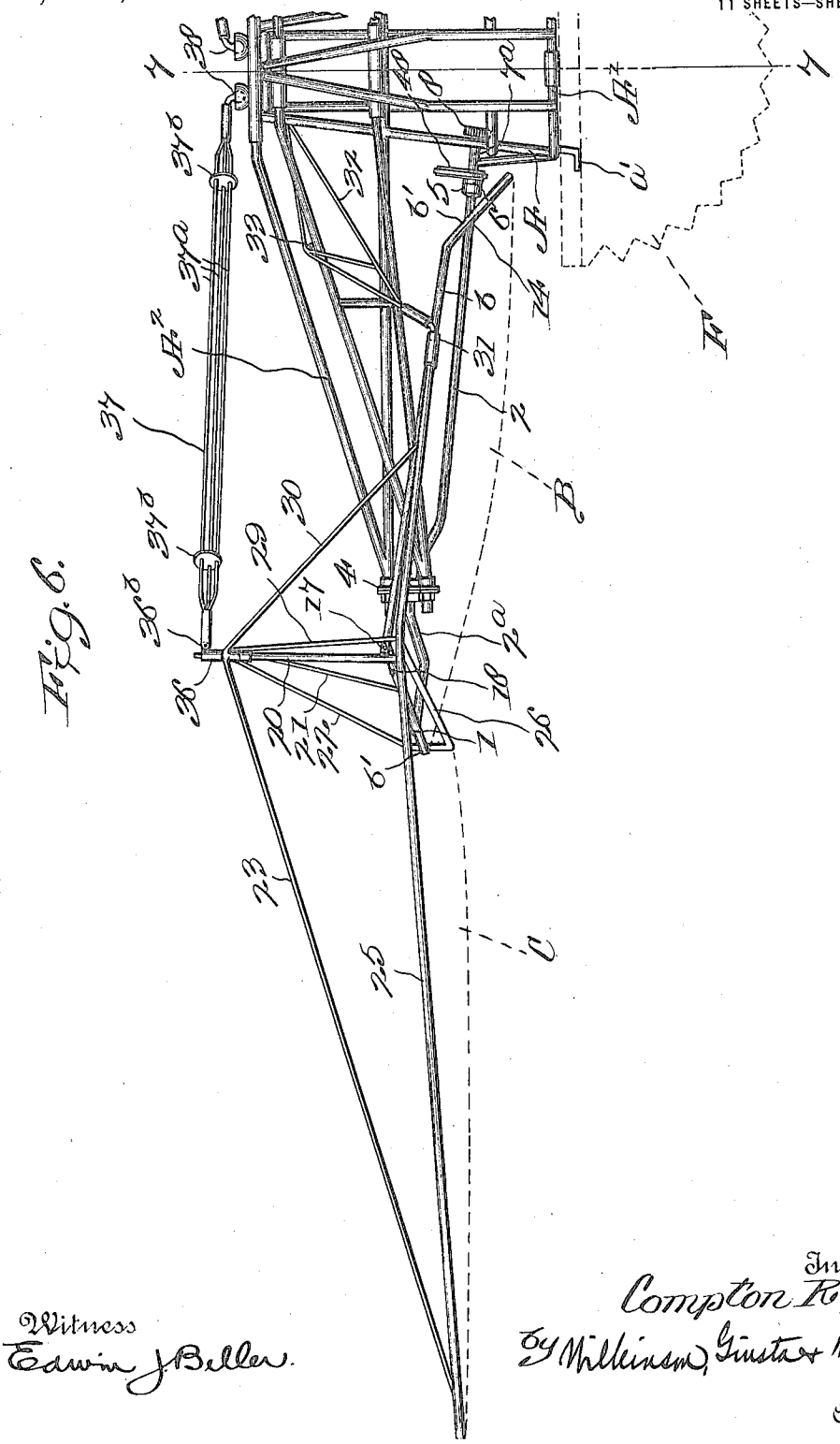


Fig. 6.

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11 SHEETS—SHEET 7.

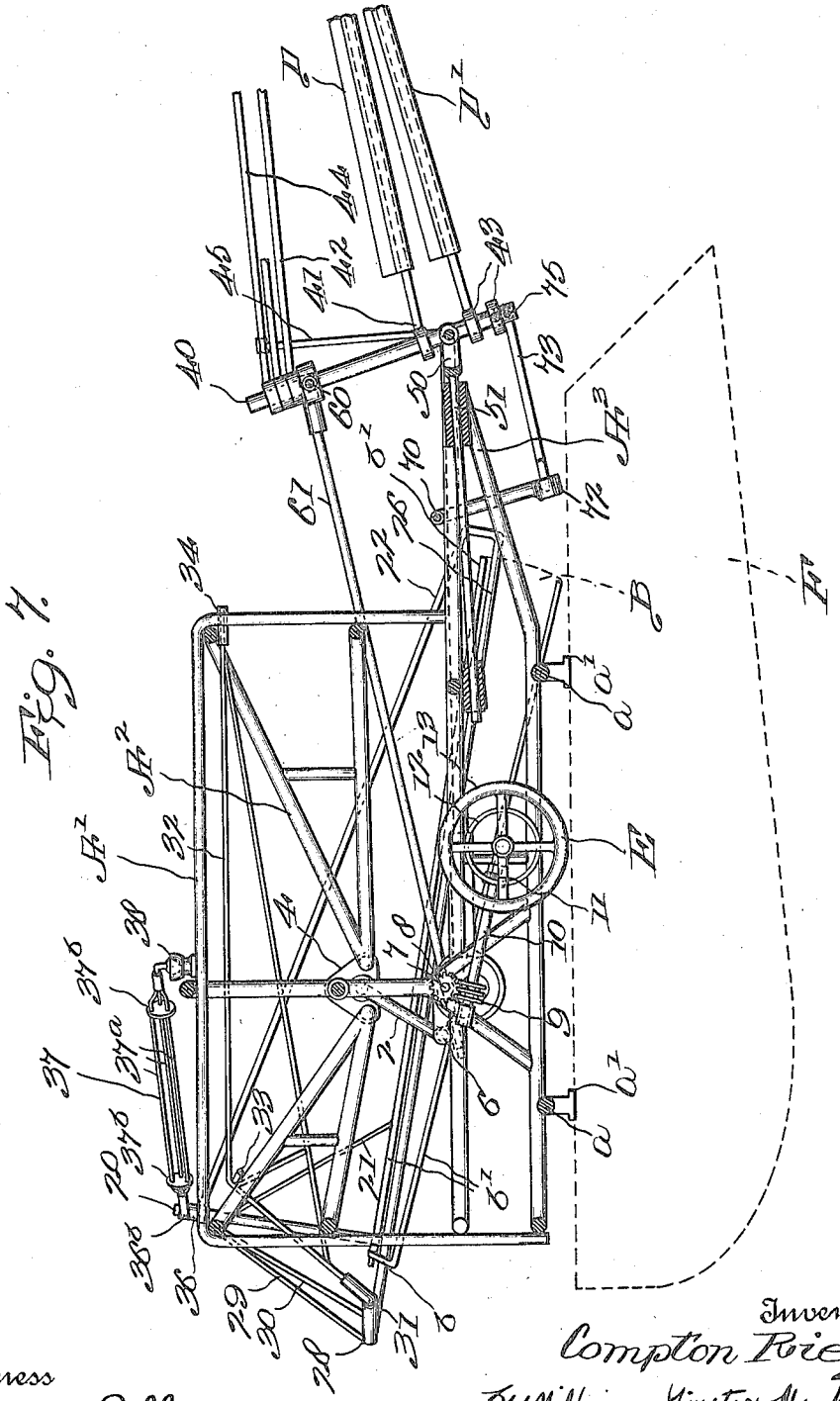


Fig. 7.

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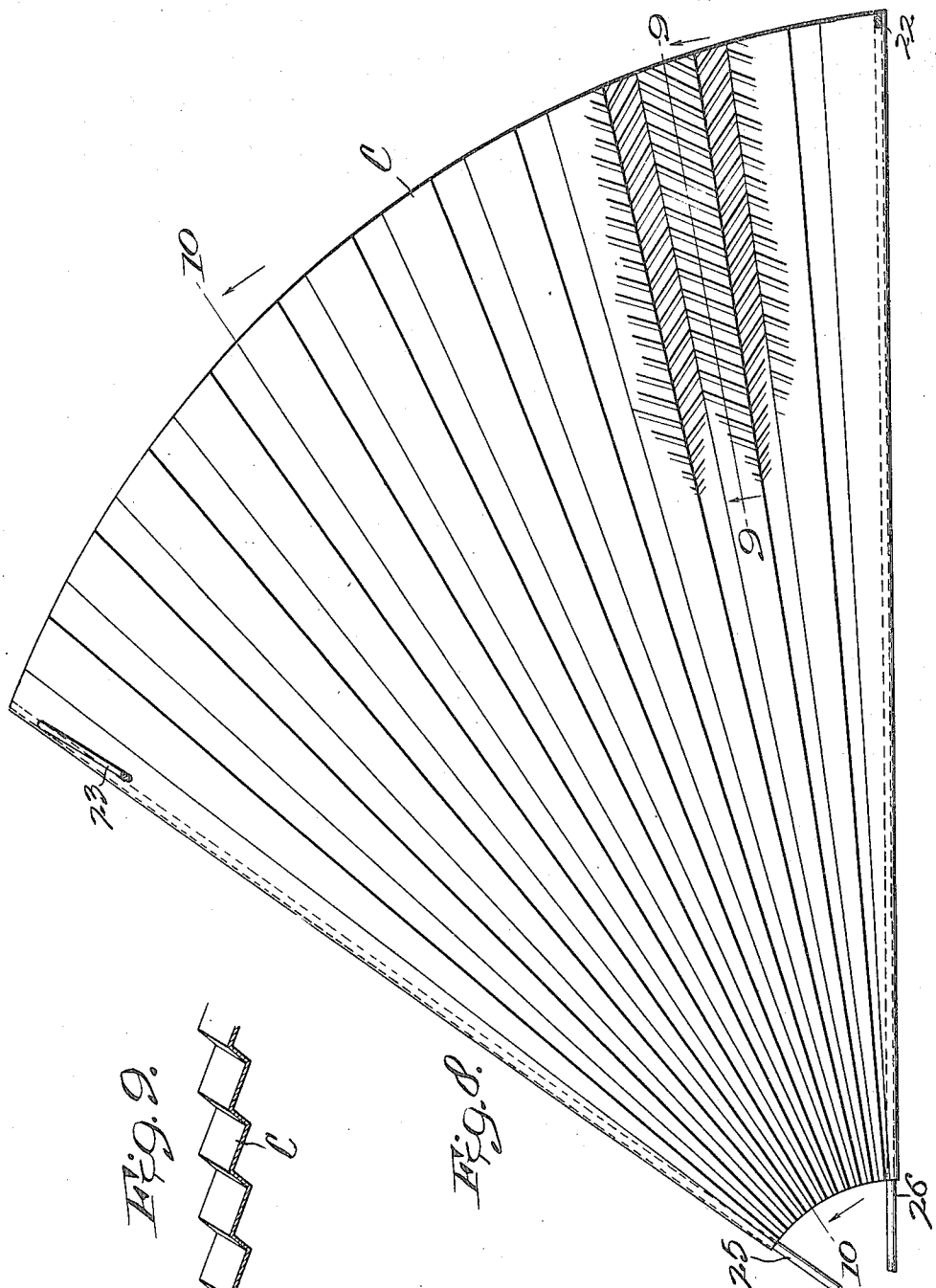



Fig. 8.




Fig. 9.

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11 SHEETS—SHEET 9.

Fig. 11.

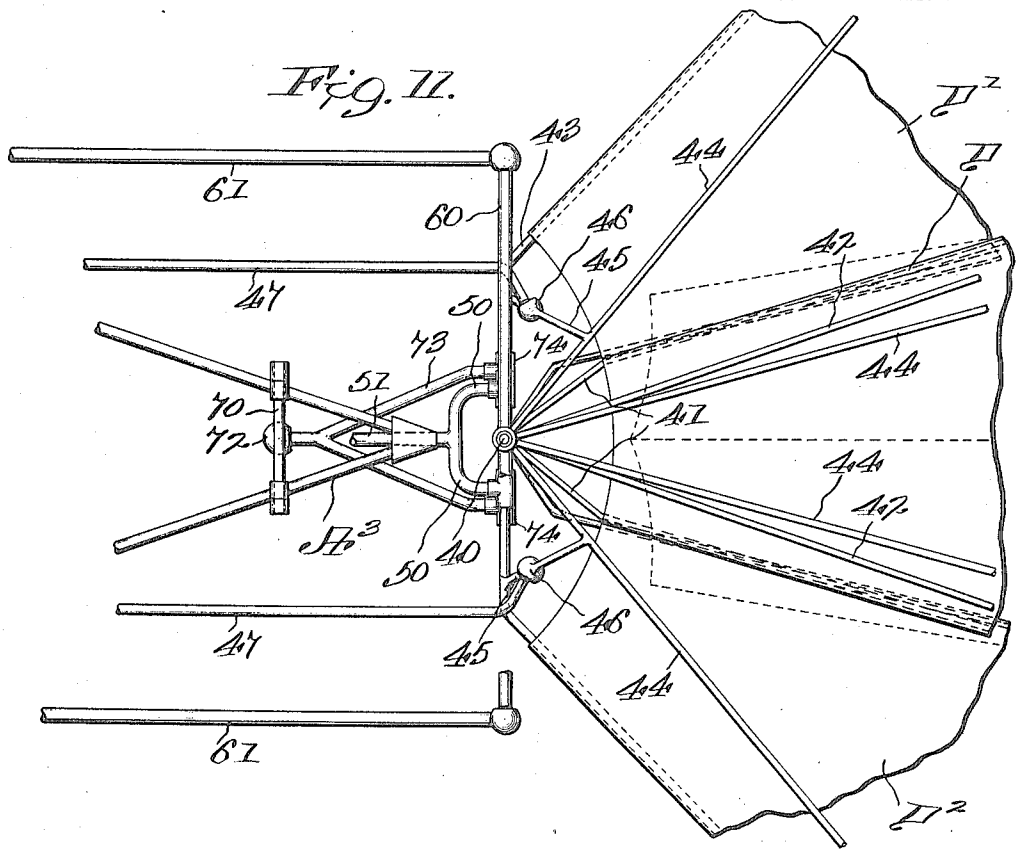
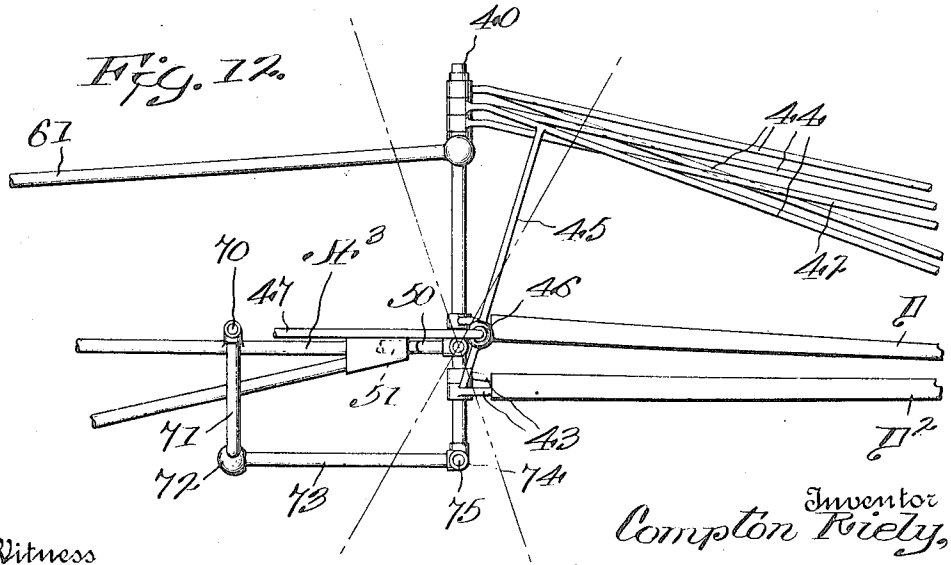



Fig. 12.




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11 SHEETS—SHEET 10.

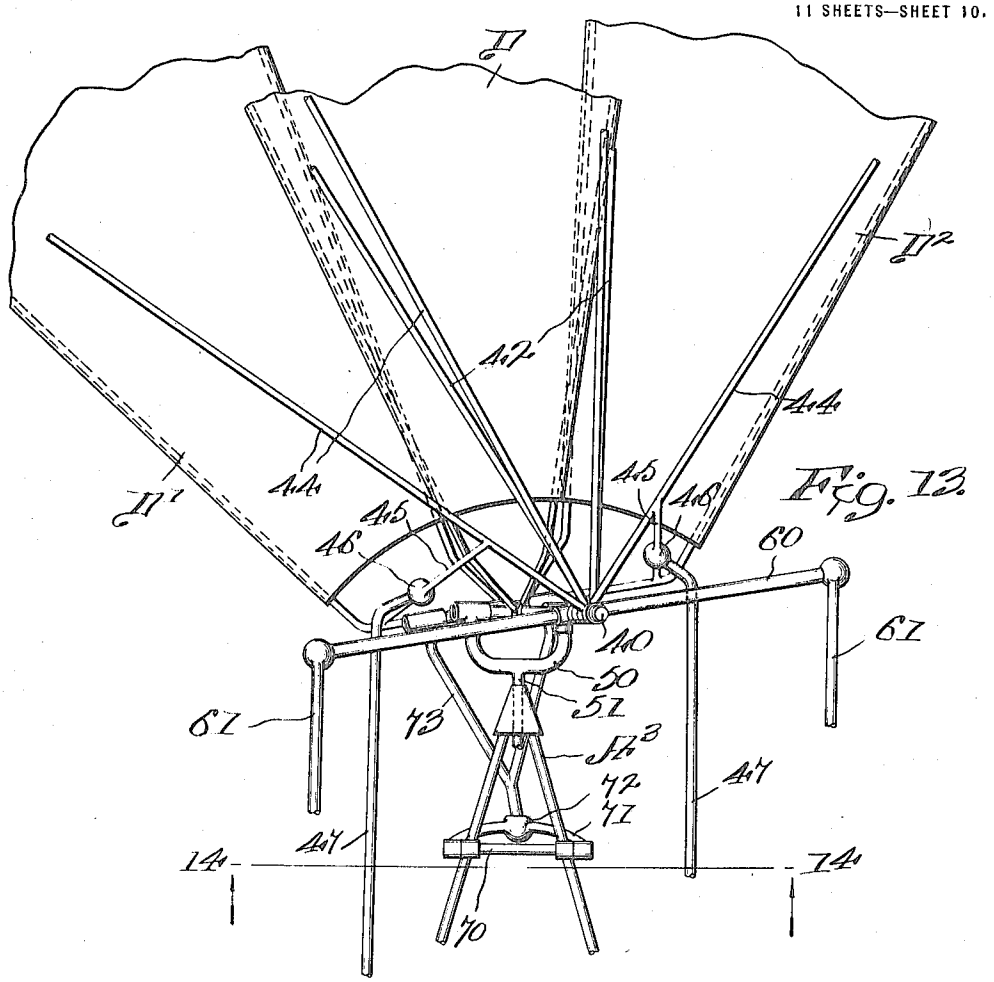



Fig. 13.

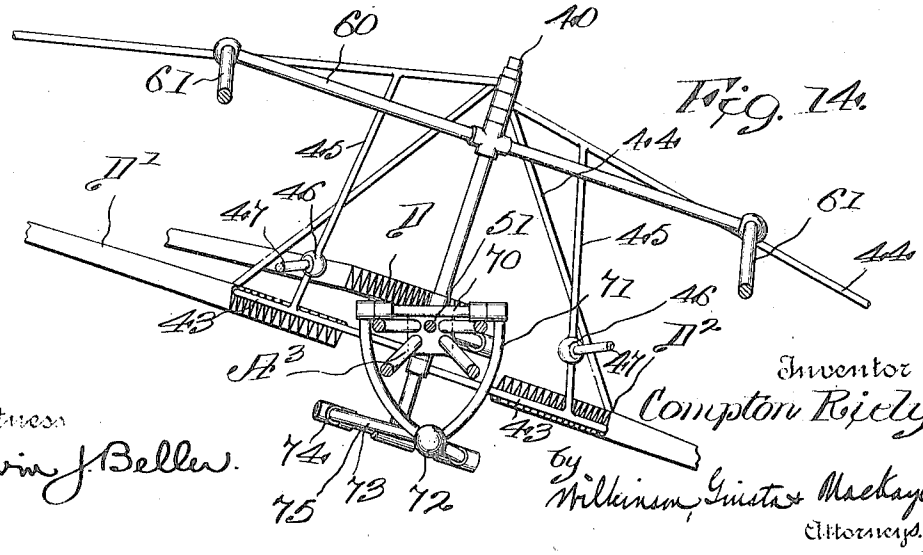



Fig. 14.

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11 SHEETS—SHEET 11.

Fig. 15.

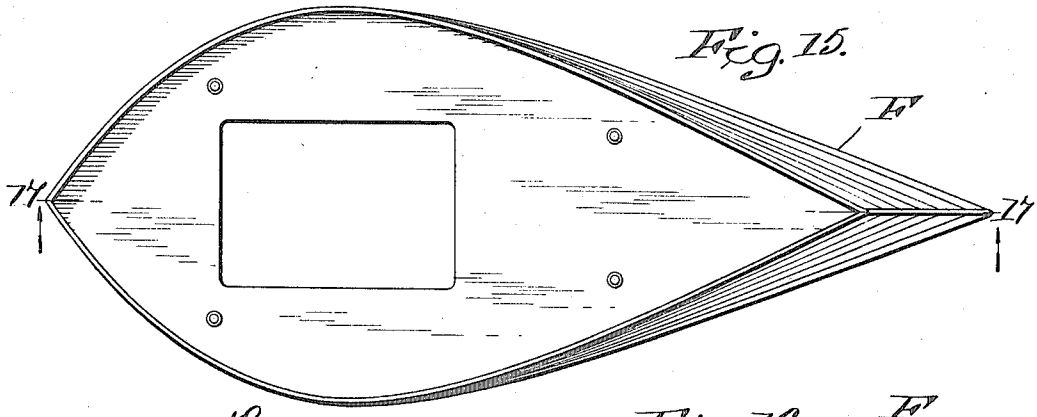



Fig. 16.

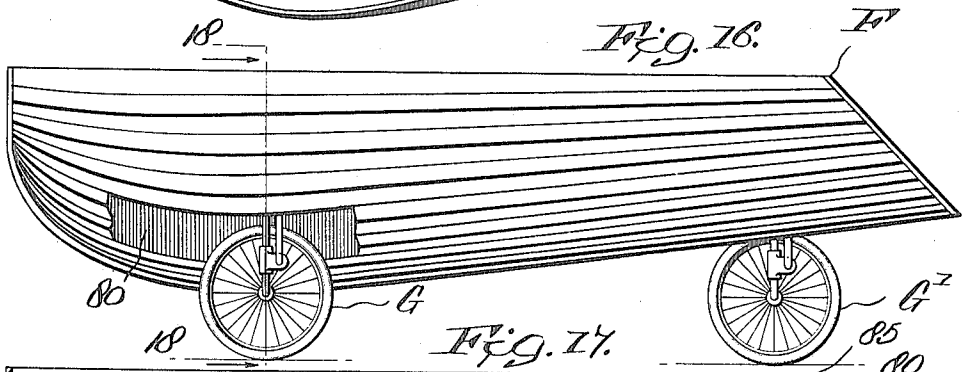
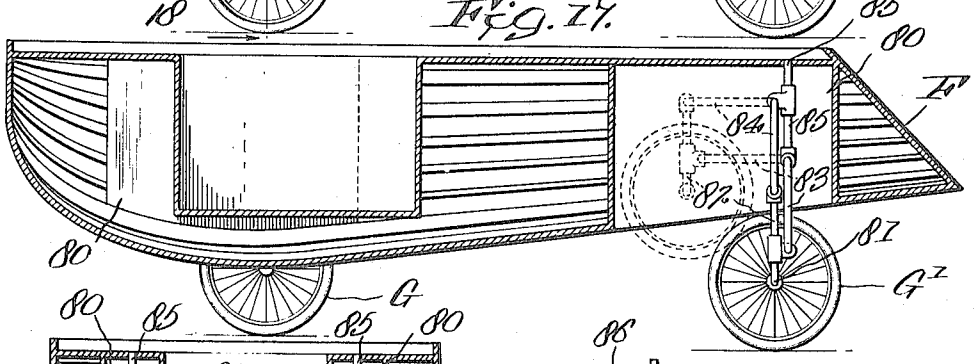



Fig. 17.



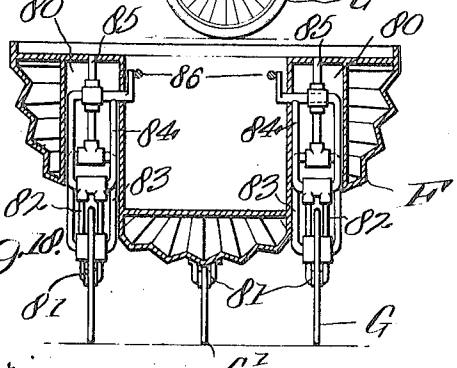




Fig. 18.

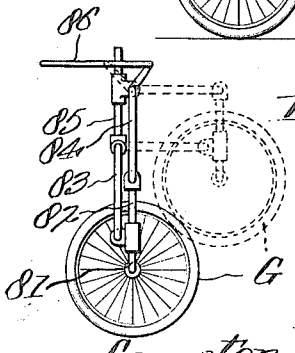



Fig. 19.

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# UNITED STATES PATENT OFFICE.

COMPTON RIELY, OF BALTIMORE, MARYLAND.

## AEROPLANE.

1,202,429. Specification of Letters Patent. Patented Oct. 24, 1916.

Application filed May 22, 1915, Serial No. 29,863. Renewed January 13, 1916. Serial No. 71,997.

*To all whom it may concern:*

Be it known that I, COMPTON RIELY, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Aeroplanes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in aeroplanes, and especially to that type known as monoplanes in which the wings and tail substantially resemble those of a bird.

The invention is intended to be applied to machines which start either from the water or from the land, or which alight either upon the water or the land; and I have shown it supported by a boat provided with disappearing wheels, with means for moving these wheels outward when it is desired to use the machine for land purposes, or they may be swung inward when in flight, so as to decrease the resistance, or when it is desired to light on shallow water, or to rise from the water.

According to my invention I form the two wing members each of two separate and independently-movable sections, and I construct the tail of three sections, each independently movable; and these various parts are firmly braced and are connected to certain pivot centers which are carried by the main framework of the machine; the idea being to accomplish, as far as practicable, by mechanical results, the natural movements of a bird in flight.

The movement of the various wing sections, and of the tail sections, and also the swinging in and out of the supporting wheels, may all be accomplished from the cock pit of the boat, or other suitable position on the platform.

My invention will be better understood after reference to the accompanying drawings, in which similar parts are indicated by similar reference symbols throughout the several views.

Figure 1 is a plan view of the complete device, with the wing segments slightly overlapping; Fig. 2 is a top plan view showing one of the wings in a slightly different position from that shown in Fig. 1, parts being broken away for the sake of clearness in the drawings; Fig. 3 is a diagrammatic view showing the framing and the supports for the wing members on one side of the machine; the wing members being shown in dotted lines and the boat being also shown in dotted lines; Fig. 4 shows a section along the line 4—4 of Fig. 3, and looking in the direction of the arrows, the tail being shown inclined downward; the corrugations in the wing members being omitted in Figs. 3 and 4 for the sake of clearness in the drawings; Fig. 5 is a diagram showing one of the wings in still another position; part of the bracing and of the framework being omitted for the sake of clearness in the drawings, the wing surfaces being shown as plane, and the corrugations being omitted; Fig. 6 is a front view of the parts of Fig. 5, the wing surfaces and the boat being shown in dotted lines; Fig. 7 shows a section along the line 7—7 of Fig. 6, the tail being shown inclined upward, and shows the parts in the same position as in Figs. 5 and 6; Fig. 8 is a plan view of one of the wing segments and shows the form of the corrugations thereon; Fig. 9 shows a section along the line 9—9 of Fig. 8, looking in the direction of the arrows; parts being shown on a larger scale; Fig. 10, shown in Sheet 2, shows a section through the wing along the line 10—10 of Fig. 8, and looking in the direction of the arrows; Figs. 11–14 represent the construction and the operation of the tail, parts being shown on a larger scale; and referring especially to each figure, Fig. 11 is a plan view showing the tail in an intermediate position from those shown in Figs. 4 and 7; Fig. 12 is a side elevation of the tail as shown in Fig. 11; Fig. 13 is a plan view of the tail showing it tilted and swung laterally; Fig. 14 shows a section along the line 14—14 of Fig. 13. In these views, the tail parts are shown plane instead of corrugated, for the sake of clearness in the drawings. Figs. 15–19 relate to the boat to which the framework of the aeroplane is attached. To describe these figures separately, Fig. 15 is a plan view of the boat as detached from the apparatus; Fig. 16 is a side elevation of the boat, showing the supporting wheels in position for starting from the ground; Fig. 17 shows a central vertical section through the boat along the line 17—17 of Fig. 15, and looking in the direction of the arrows; the trail wheel and its support being shown in elevation and in the lowered position, as for running on the ground; Fig. 18 shows a trans-

verse section through the boat along the line 18—18 of Fig. 16, with the supporting wheels in position for running on the ground; and Fig. 19 is a detail showing the mode in which the supporting wheels may be folded up into the boat when it is desired to light on the water.

A represents the main framework of the machine, which consists substantially of a main central portion A′, with two lateral extensions $A^2$, from which lateral extensions the inner members B of the two wings are supported, as will be hereinafter described. The main frame has also a rearward extension $A^3$, to which the tail members are connected, as will be hereinafter described.

The outer wing members C are connected to the inner wing members and to the main frame by a series of trusses, as will be hereinafter described; and the tail members, comprising the central tail member D and the outer tail members D′ and $D^2$, are connected to the main frame and to the inner wing members B so that the various tail members may have an up and down movement, a lateral movement, and also a twisting movement, as will be hereinafter more fully described. These various movements of the wing members and of the tail members are accomplished by suitable gearing, and other mechanism controlled by two hand wheels E and E′, which are mounted in the main frame, and which may be controlled together, or singly, by the operator as may be desired.

The main frame is mounted on any suitable running support, such as the boat F, provided with the front wheels G and the rear or trail wheel G′. The wing and tail members are preferably corrugated, as shown in Figs. 1, 2, 8, 9 and 10, conforming to the construction of the feathers of a bird, as will be hereinafter more fully described; and the hull of the boat is also preferably corrugated as shown, so as to secure the advantage of a fin keel construction in entering the water at a high speed, which would tend to steady the boat in the water, and also secure the similar, but less marked, results on the boat when the machine is flying through the air.

I represents the propeller, shown only in Fig. 1. The motive power may be of any suitable type, and not being a part of my invention is not shown or described herein, such motive power being well known in the art.

Having thus described, in a general way, the principal parts of the construction, I will now proceed to describe the details of the several parts, and their connections with the main frame; after which I will describe the operation of the device as a whole.

The main frame A, with its body portion A′ and its lateral extensions $A^2$, and the tail-bearing member $A^3$, is made of any suitable trussed construction, preferably out of hollow tubes of metal of high tensile strength, such as vanadium steel. This frame is secured to the boat, or other platform, in any convenient way, as by means of the cross bars *a*, provided with ears *a*′, which are connected to the platform or boat as by means of suitable bolts, but any other fastening means for securing the main frame to the platform may be adopted if desired.

The inner wing members B are preferably made of a corrugated plate of thin metal, which is stiffened at the front and sides by suitable rods *b* and *b*′. It may also be stiffened at the back if desired, and additional stiffening members may be added wherever needed. This plate is corrugated in the form of V-shaped ridges, which spread out somewhat like the folds of a fan, as shown in Figs. 1 and 2, and 8 and 9, the ridges being deeper at the front and terminating in the rear surface in a substantially flat portion, similar to the corrugations in the outer wing members C, as will be hereinafter more fully described.

The inner wing members B are each connected, as at 1, to the rod 2 which is provided with a ball and socket joint 3, see Figs. 2, 3 and 5, in the bearing 4 of the lateral extension $A^2$ of the main frame A. The inner end of this rod 2 is connected, by a ball and socket joint 5, to the crank 6 on the shaft 7 which passes through the sleeve $7^a$, fast to the main frame, which shaft carries the gear 8, meshing with the worm 9 on the shaft 10, driven by the beveled pinion 11 and the beveled gear 12 fast to the hand wheel 13.

All the parts being symmetrically disposed on both sides of the device, it will only be necessary to describe one side.

The rod 2 is fastened to the wings at 1 and 14, and serves as a brace for the back of same; being bent up, as at $2^a$, see Fig. 3, where it enters the bearing 4, see Figs. 2 and 5. The inner wing member B is provided on its outer edge with lugs 16 and 17, in which is journaled the bearing bar 18, to which the wing post 20 and the brace 21 therefor are connected. This post 20 forms the axis about which the outer wing member C rotates, and is connected to the rear inner corner of the outer wing member by the brace 22, and to the outer and forward corner of the wing member C by the brace 23. The outer and inner edges of the wing member C are stiffened by the tubes 25 and 26, respectively, and the braces 27 and 28 form with the members 25 and 26 a frame, which is connected to the main post 20 by the braces 29 and 30; the parts 20 to 30 inclusive forming a trussed construction by which the wing C is stiffened and supported,

and this trussed construction is connected by a ball and socket joint 31 to the truss 32, which is pivoted at 33 and 34 to the main frame, and is free to rock through a small angle on said frame, permitting the outer wing member to be swung outward and inward, as will be hereinafter described.

The head of the post 20 engages a sleeve 36, which is hinged, as at $36^b$, to the truss member 37, the inner end of which truss member is connected, as at 38, by a ball and socket joint to the main frame. I have shown this truss member 37 made of a series of rods $37^a$, passing through and held apart by the disks $37^b$; but any suitable form of truss having the requisite tensile strength and stiffness may be used if desired.

Thus it will be seen that the inner wing member B can be moved about a pivot 4, while the outer wing member can be swung laterally about the post 20, can be rocked about the bearing 31, and can be tilted from the tip inward because the head of the post 20 has a slight rocking motion, due to the hinge $36^b$. The post 20, being hinged to the bearing bar 18, causes the wing member C to partake of an inward or outward movement with the wing member B, so that these two members are in a measure linked together and move together, forward or backward, causing the wing surface to be greater when the crank 6 is thrown forward, and less when it is thrown rearward; and the center of lifting surface is moved forward as the crank is thrown forward and moved rearward as the crank is turned rearward, as will be hereinafter more fully described.

The tail consists of three members, the central member D and the two side members D′ and $D^2$. The central member D is rigidly attached to the tail post 40 by the bracket 41 and the braces 42, while the outer tail members D′ and $D^2$ are pivotally connected to the tail post 40 by means of the brackets 43 and the braces 44. These braces 44 are further connected with the brackets 43 by the vertical rods 45, provided with universal joint bearings 46 for the eccentric rods 47, which engage the eccentrics 48 on the shafts 7, so that as either shaft 7 is rotated the outer tail member is swung inward or outward, and also tilted, as will be hereinafter more fully described.

The tail post 40 is fast to the yoke 50, which is carried by the rod 51, journaled in the tail member $A^3$ of the main frame A, so that this tail post may be rocked about the axis of said rod 51 as a pivot. The tail post 40 is journaled near its upper end in the cross bar 60, which is hinged at each end to one of the rods 61, which are hinged to the rods 2, so that each rod 61 is moved by the corresponding crank 6 for the purpose of moving the tail post and tail members, as will be hereinafter described.

The tail piece $A^3$ of the main frame A carries a rod 70, to which the yoke 71 is hinged, as shown most clearly in Figs. 13 and 14; and this yoke is connected by the ball and socket joint 72 to the yoke 73, which has a hinged connection 74 to the cross rod 75, which is rigidly attached to the heel of the tail post 40, and thus the movement of the yoke 71 will tilt the tail post in the direction of the axis of the aeroplane, except that the direction of this movement of the tail post will be compounded with the movements of the various other parts, as will be hereinafter more fully described.

It will thus be seen that the central tail member swings laterally with the tail post, and has a compounded tilting motion, due to the movement of the rods 61 and of the yoke 73, while the outer tail members also tilt up and down with the tail post 40, and have a swinging movement laterally due to the movement of the rods 47. The tail members thus partake of three movements, due to the following agencies:—(1) the movement of the rods 61; (2) the movement of the yoke 73; and (3) the movement of the eccentric rods 47.

It will be noted that the rotation of the shaft 7 moves the rod 2 and swings the inner member B, thereby also swinging the outer wing member C about its post 20; and the same motion of this shaft 7 will also move the eccentric 48 and the eccentric rods 47, swinging the outer tail member backward or forward, as the case may be, about the tail post 40. This same movement of the shaft 7 will also pull on the rod 61, tending to tilt the upper end of the tail post forward and to one side or the other, according to which hand wheel E or E′ is turned. As it swings under the action of the rods, the lower end of the tail post 40 is guided by the yokes 71 and 73, and when both the wheels E and E′ are turned to give the same movement in lift for the wing members, all three members of the tail are tilted upward, as shown in Fig. 7; whereas when it is desired to decrease the lifting effect of the wings, if both the hand wheels E and E′ be moved through the same angle, the three tail members will be depressed, as shown in Fig. 4. Any variations in the relative movement of the two hand wheels E and E′ will cause the wing members on the respective sides to be set at a varying angle of lift, and will cause the tail to twist or incline laterally, due to the compounding of the movements already described.

It will also be seen that as either one of the shafts 7 is rotated, the two wing members on that side will be swung in or out, relative to each other, increasing or decreasing the spread of the wing, and at the same time the center of the lifting surface is

moved forward when the wing area is increased and backward when it is decreased. Thus it will be seen that the two wings may be independently varied in spread, and also that the angle of lift may be varied within set limitations, and also that the tip of the wing may be tilted up or down, as desired; while the tail might be spread or contracted, and tilted up or down, or twisted, so that these several parts have a freedom of movement generally resembling the corresponding parts of a bird.

By having the wing members and tail members corrugated, as shown, the construction of the feathers of a bird is in a measure imitated, and I believe greater stability in flight and lifting power are secured thereby.

By having the boat corrugated, as shown, greater stability in the water is secured, especially when moving rapidly, in either lighting on or leaving the water, or in skimming along the water.

In addition to the longitudinal corrugations, the boat may be provided with secondary corrugations transverse to the main corrugations similar to those shown on the wing surface in Fig. 8.

In order to place the wheels in a safe and protected position, I provide the wheel chambers 80 in the boat F, adapted to receive the wheels and their supporting mechanism, and the wheels are mounted on stub axles 81, which are connected to the yoke 82, and said yoke is connected by the hinged links 83 and 84 to the post 85, secured to the boat. The upper link 84 is turned to the horizontal position by means of the rod 86.

When in the vertical position shown in Fig. 19, we have an articulated joint, analogous in its action to the knee joint of a bird, and the wheel will be held rigidly, and in the projected position; by simply turning on the hand crank 86 the joint may be broken and the parts swung to the position indicated in dotted lines in Fig. 19.

Having thus described the details of the various parts, and the various movements accomplished by the hand wheels E and E′, respectively, which movements are similar on each side of the apparatus, I will now proceed to describe the operation of the device as a whole.

Fig. 1 shows a plan view of the complete apparatus in the normal flying position, with both wings extended equally, and with the tail in the position for flying straight ahead. This would be ordinarily the normal position of the parts of the apparatus when the aeroplane is flying ahead, or at rest on the ground, or on the water, as the case may be.

Now supposing the aeroplane to be at rest on the water, or on the ground, and it be desired to rise, before starting the engine turn both hand wheels E and E′ until both cranks 6 project forward, as shown in Figs. 5 and 7. This will extend the two wings, as shown in Fig. 5, and at the same time will tilt the same upward, as shown in Fig. 7, and the same movement will cause the rod 61 to pull the cross bar 60 forward, tilting the tail up to the position shown in Fig. 7; now if the engine be started, the aeroplane will rise. Supposing the aeroplane to be in the air, and it be desired to descend, turn both hand wheels E and E′ in the opposite direction, reversing the positions of the two cranks 6 and causing the same to project to the rear, as shown in Fig. 2. This will cause the outer wing members to be drawn in relatively to the inner wing members, contracting the spread of the wings, as shown in Fig. 2, and at the same time will lessen the lift of the wings, as shown in Fig. 4; and simultaneously the rods 61 will push the cross bar 60 backward, turning the tail down, as shown in Fig. 4, the result being that the rear end of the machine will be tilted up and the nose of the machine tilted down, and the machine will descend at an angle dependent upon the extent of the movement of the hand wheels E and E′.

Now if it is desired to turn the aeroplane in either direction, this may be accomplished slowly by extending the wing on one side, which will cause the aeroplane to swing slowly to the side having the extended wing; or the same result may be accomplished by leaving one wing constant and contracting the other wing, or if it is desired to turn quickly one wing may be extended and the opposite wing contracted. In any event, the inertia of the machine would tend to cause its center of gravity to continue forward in a straight line; but the resistance of the air on the extended wing, being greater than the resistance of the air on the contracted wing, would cause this inertia to swing that side of the machine having the contracted wing through an arc whose center lies on the side of the machine having the extended wing. This action is supplemented by the further fact that when the wing is extended it is at a greater angle of lift than when it is contracted; and the consequence is that the resistance of the air on the extended wing per unit of surface would be greater than the resistance of the air on the contracted wing, and thus the turning effect around the extended wing would be still further accentuated, as is the case with birds.

A further analogy to the action of a bird results from the action of the tail when the wings are moved as stated. When either wing is spread or contracted that side of the tail is correspondingly spread or contracted, so that when the wings are expanded and set for rising the tail is also expanded and set for rising, thus increasing the total lift-

ing surface; while when the wings are contracted and set for descending, the tail surface will also be contracted and set for descending, and the total lifting surface will be decreased. Moreover when the front of both wings is simultaneously tilted up, as in rising, the rear of the tail is also tilted up by the action of the mechanism as before described; also when the front of both of the wings is tilted down the rear of the tail is also tilted down, as in the operation of descending already described. Thus, not only will the lift angle be increased when the wings and tail are spread, but the lifting surface will be increased, and the machine is specially adapted for rising rapidly. On the other hand, when the lift angle is decreased the wings and tail are both contracted, and the machine has a tendency to settle while gliding downward, thus facilitating the speed and ease with which the machine lights.

The downward glide can, of course, be checked at any time by shifting the wings and tail toward the position for lifting.

It will thus be seen that I provide a machine having maximum area of surface for lifting, minimum area of surface for descending, and intermediate areas of surface for the normal operation of continuous flying.

Now for the purposes of turning, if the wing on one side be extended there will be an extension of that side of the tail, and a slight tilting of the tail post toward the side corresponding to the wing so spread; while if the other wing is contracted the other side of the tail will be contracted, and this twist of the tail will be augmented. The result will be that the tail will supplement the turning effect of the out-stretched wing, causing the aeroplane to turn still faster about that wing.

It will be obvious that by manipulating one hand wheel to lift, and the other hand wheel to descend, either simultaneously or alternately, the aeroplane may be balanced in the air, or if tilted from any cause may be restored to the level position.

I prefer to have the two hand wheels each independently operated. This may be done by either one or two operators; or it might be possible to so connect the hand wheels E and E′ by suitable clutch or other mechanism that they might normally operate together under ordinary conditions of flying, and may be each independently controlled if desired.

It will thus be seen that I provide an aeroplane in which the wings may be each independently extended or contracted, or tilted up or down as may be desired, and in which the tail may be tilted up or down, extended or contracted, or twisted in either direction as may be desired, following the movements of a bird in soaring, the result being that the aeroplane may be caused to fly straight ahead, to rise or descend, to circle in either direction, or to be balanced to meet abnormal atmospheric or other conditions.

The corrugated surface of the wings and tail, I believe, will give better lifting effect and will also tend to assist in the directive effect in the air of the machine, and in a measure compensate for erratic movement in steadying the same. It will be obvious, however, that the wing and tail surfaces may be made arched or plane, or of any desired shape, without affecting certain fundamental principles of the mechanism hereinbefore described.

While I have shown the framing and bracing as of light skeleton tubular structure, any suitable form, or arrangement, of framework and bracing for the several parts may be adopted, and I do not mean to limit myself to details of construction except as specified in the claims.

It will be obvious that various modifications might be made in the herein described apparatus, and in the construction, combination and arrangement of parts which could be used without departing from the spirit of my invention.

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

1. In an aeroplane the combination with an extensible wing, of means for extending said wing and simultaneously increasing the lift angle of all portions of the wing, and for contracting said wing and simultaneously decreasing the lift angle of all portions of the wing, substantially as described.

2. In an aeroplane the combination with an extensible wing, of a hand wheel and mechanism operated thereby for extending said wing and simultaneously increasing the lift angle of all portions of the wing, and for contracting said wing and simultaneously decreasing the lift angle of all portions of the wing, substantially as described.

3. In an aeroplane the combination with a pair of extensible wings, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, and a collapsible tail composed of a plurality of members, with means automatically controlled when said wings are extended or contracted for raising or lowering, or twisting said tail, substantially as described.

4. In an aeroplane the combination with a pair of extensible wings, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, said means comprising hand wheels and mechanism operated thereby for extending and contracting

said wings, and for tilting same, and a collapsible tail composed of a plurality of members, with means automatically controlled when said wings are extended or contracted for raising or lowering, or twisting said tail, substantially as described.

5. In an aeroplane the combination with an extensible wing, composed of two relatively movable wing members, of means for simultaneously extending said wing members and simultaneously increasing the lift angle of each, and for simultaneously contracting said wing members and simultaneously decreasing the lift angle, substantially as described.

6. In an aeroplane the combination with an extensible wing, composed of two relatively movable wing members, of a hand wheel and mechanism operated thereby for simultaneously extending said wing members and simultaneously increasing the lift angle of each, and for simultaneously contracting said wing members and simultaneously decreasing the lift angle of each, substantially as described.

7. In an aeroplane the combination with an extensible wing, composed of two relatively movable wing members, of a hand wheel and mechanism operated thereby for extending said wing members and simultaneously increasing the lift angle, and for contracting said wing members and simultaneously decreasing the lift angle, substantially as described.

8. In an aeroplane the combination with a pair of extensible wings, each composed of two relatively movable wing members, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, and a collapsible tail composed of a plurality of members, with means automatically controlled by the operation of said wings for spreading or contracting, or raising or lowering, or twisting said tail, substantially as described.

9. In an aeroplane the combination with a pair of extensible wings, each composed of two relatively movable wing members, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, said means comprising hand wheels and mechanism operated thereby for extending and contracting said wings, and for tilting same, and a collapsible tail composed of a plurality of members, with means automatically controlled by said hand wheels incident to the controlling of said wings, for spreading or contracting, raising or lowering, or twisting said tail, substantially as described.

10. In an aeroplane the combination with a pair of extensible wings and an extensible tail, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, said means also controlling the movements of said tail, substantially as described.

11. In an aeroplane the combination with a pair of extensible wings and an extensible tail, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, said means also controlling the movements of said tail, and said means comprising a hand wheel for each wing, and mechanism connecting said hand wheels to said wings and tail, and controlling the same, substantially as described.

12. In an aeroplane the combination with an extensible wing, composed of two relatively movable wing members, and a tail composed of a central member and two laterally movable side members, of means for simultaneously extending said wing members and said tail members and simultaneously increasing the lift angle of said wing members, and for simultaneously contracting said wing members and said tail members and simultaneously decreasing the lift angle of said wing members, substantially as described.

13. In an aeroplane the combination with an extensible wing, composed of two relatively movable wing members, and a tail composed of a central member and two laterally movable side members, of hand wheels, with mechanism controlled thereby for simultaneously extending said wing members and said tail members and simultaneously increasing the lift angle of said wing members, and for simultaneously contracting said wing members and said tail members and simultaneously decreasing the lift angle of said wing members, substantially as described.

14. In an aeroplane the combination with a pair of extensible wings, and a tail composed of a central member and two laterally movable side members, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, said means also automatically controlling the corresponding tail members incident to the movement of the wings, substantially as described.

15. In an aeroplane the combination with a pair of extensible wings, each composed of a pair of wing members movably connected to the main frame of the machine and to each other, and a tail composed of a central member and two laterally movable side members, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, said means also automatically controlling the corresponding tail members incident to the movement of the wings, substantially as described.

16. In an aeroplane the combination with a main frame and a pair of extensible wings, each composed of two relatively movable wing members, movably connected to said main frame and to each other, of means for independently extending each wing and contracting same, and for simultaneously increasing the lift angle of all portions of said wing when it is extended, said means comprising hand wheels and mechanism operated thereby for extending and constructing said wings, and for tilting same, substantially as described.

17. In an aeroplane the combination with a pair of extensible wings, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, and a collapsible tail composed of a plurality of members, with means automatically controlled by the operation of said wings for spreading or contracting, or raising or lowering, or twisting said tail, substantially as described.

18. In an aeroplane the combination with a pair of extensible wings, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, said means comprising hand wheels and mechanism operated thereby for extending and contracting said wings, and for tilting same, and a collapsible tail composed of a plurality of members, with means automatically controlled by said hand wheels incident to the controlling of said wings, for spreading or contracting, raising or lowering, or twisting said tail, substantially as described.

19. An aeroplane having its lifting surfaces in the form of V-shaped corrugations, flattening outward toward the rear, substantially as described.

20. An aeroplane having its wings provided with lifting surfaces in the form of V-shaped corrugations, flattening outward toward the rear, substantially as described.

21. An aeroplane having its tail provided with lifting surfaces in the form of V-shaped corrugations, flattening outward toward the rear, substantially as described.

22. In an aeroplane the combination with an extensible wing, comprising an inner and an outer wing member, of means for extending said wing and simultaneously increasing the lift angle, and for contracting said wing and simultaneously decreasing the lift angle, and also tilting the tip of the outer wing member about the longitudinal axis of the wing, substantially as described.

23. In an aeroplane the combination with an extensible wing, comprising an inner and an outer wing member, of a hand wheel and mechanism operated thereby for extending said wing and simultaneously increasing the lift angle, and for contracting said wing and simultaneously decreasing the lift angle, and also tilting the tip of the outer wing member about the longitudinal axis of the wing, substantially as described.

24. In an aeroplane the combination with a pair of extensible wings each comprising an inner and an outer wing member, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, and also tilting the tip of the outer wing member about the longitudinal axis of the wing, substantially as described.

25. In an aeroplane the combination with a pair of extensible wings each comprising an inner and an outer wing member, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, and also tilting the tip of the outer wing member about the longitudinal axis of the wing, said means comprising hand wheels and mechanism operated thereby for extending and contracting said wings, and for tilting same, substantially as described.

26. In an aeroplane the combination with a pair of extensible wings each comprising an inner and an outer wing member, of means for independently extending each wing and contracting same, and for simultaneously altering the lift angle of said wing, and also tilting the tip of the outer wing member about the longitudinal axis of the wing, and a collapsible tail composed of a plurality of members, with means automatically controlled when said wings are extended or contracted for raising or lowering, or twisting said tail, substantially as described.

In testimony whereof I affix my signature.

COMPTON RIELY.