

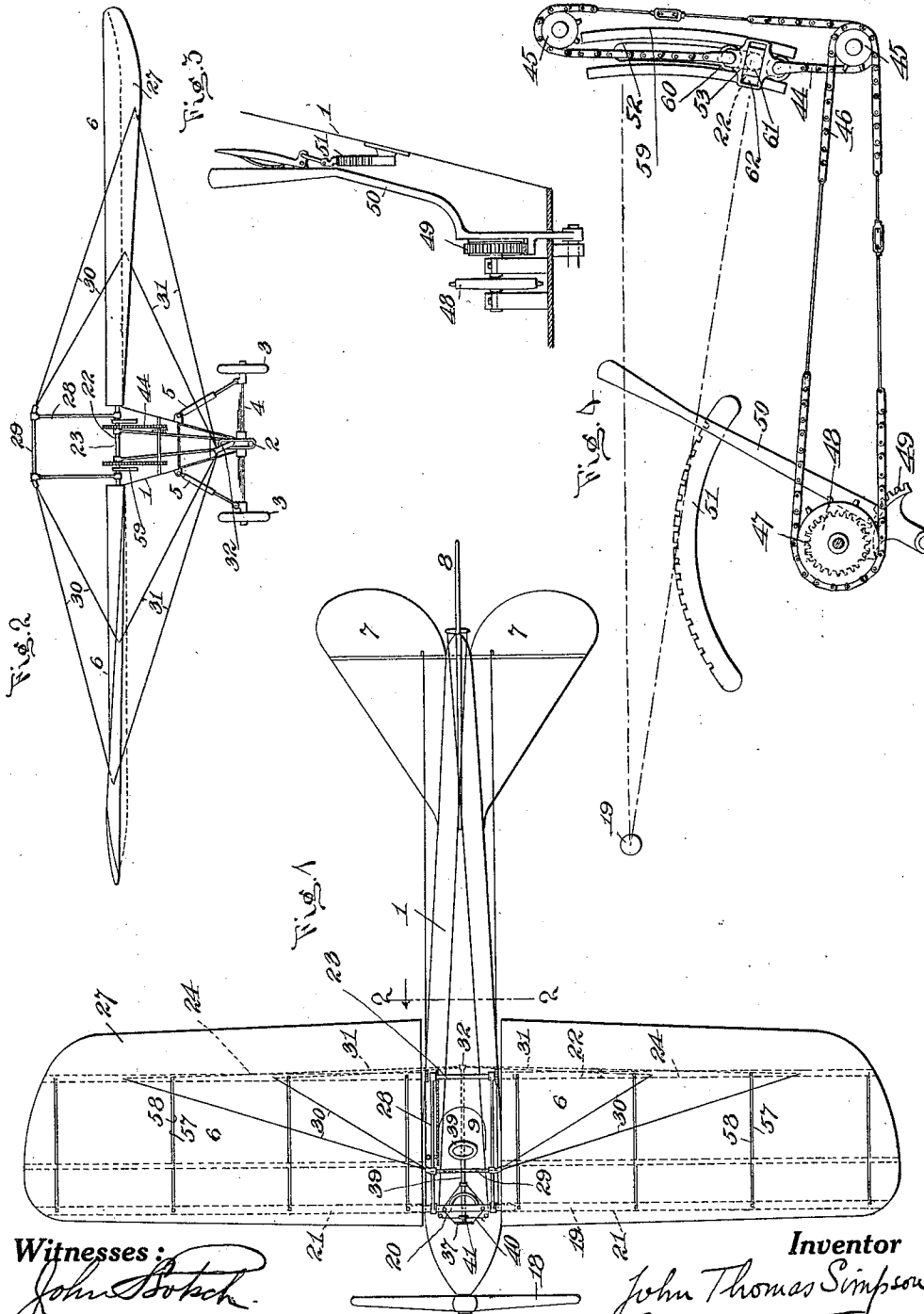
J. T. SIMPSON.
AEROPLANE.

APPLICATION FILED MAR. 27, 1912.

Patented May 26, 1914.

3 SHEETS-SHEET 1.

1,098,131.



Witnesses:

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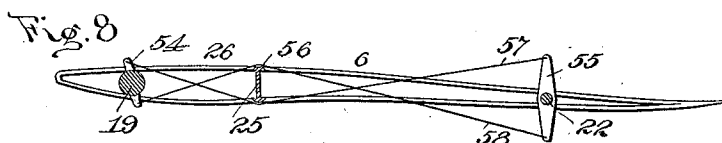
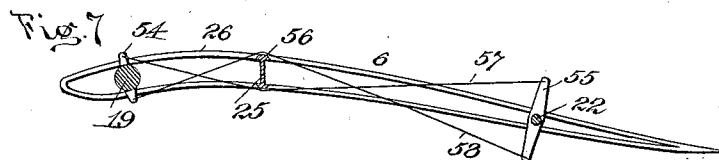
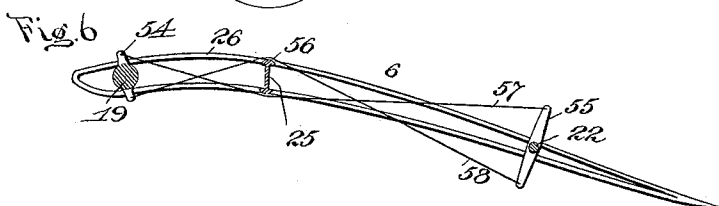
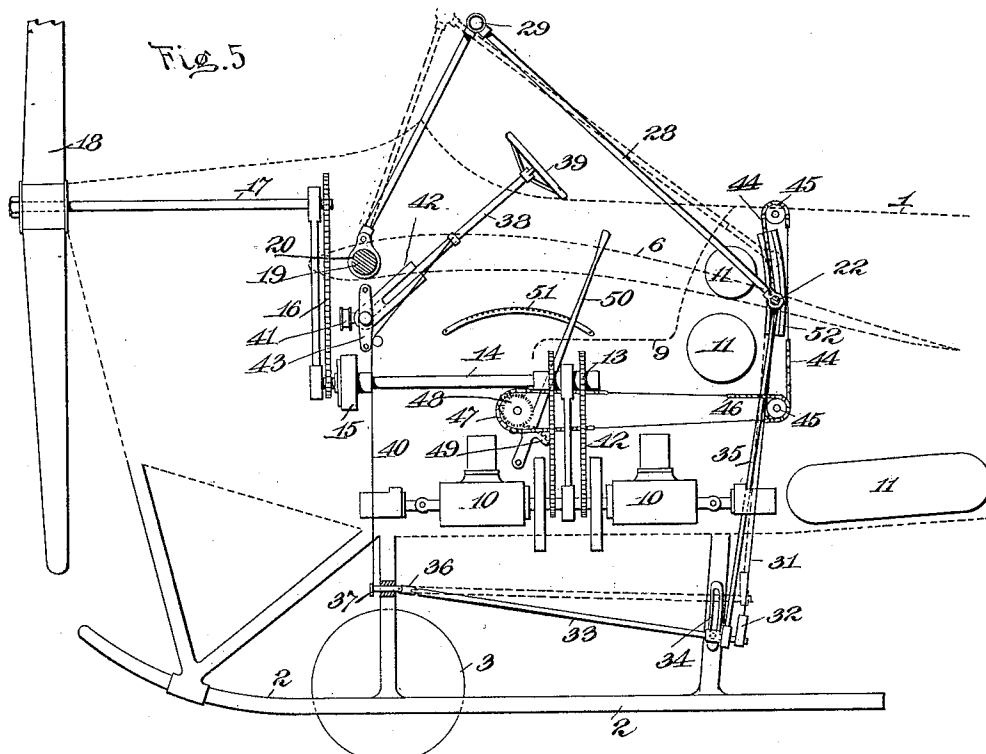
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3 SHEETS—SHEET 2.

1,098,131.



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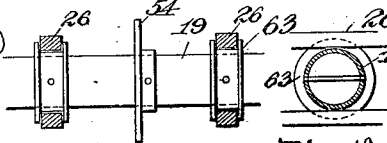


Fig. 9

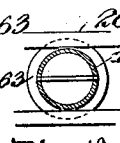


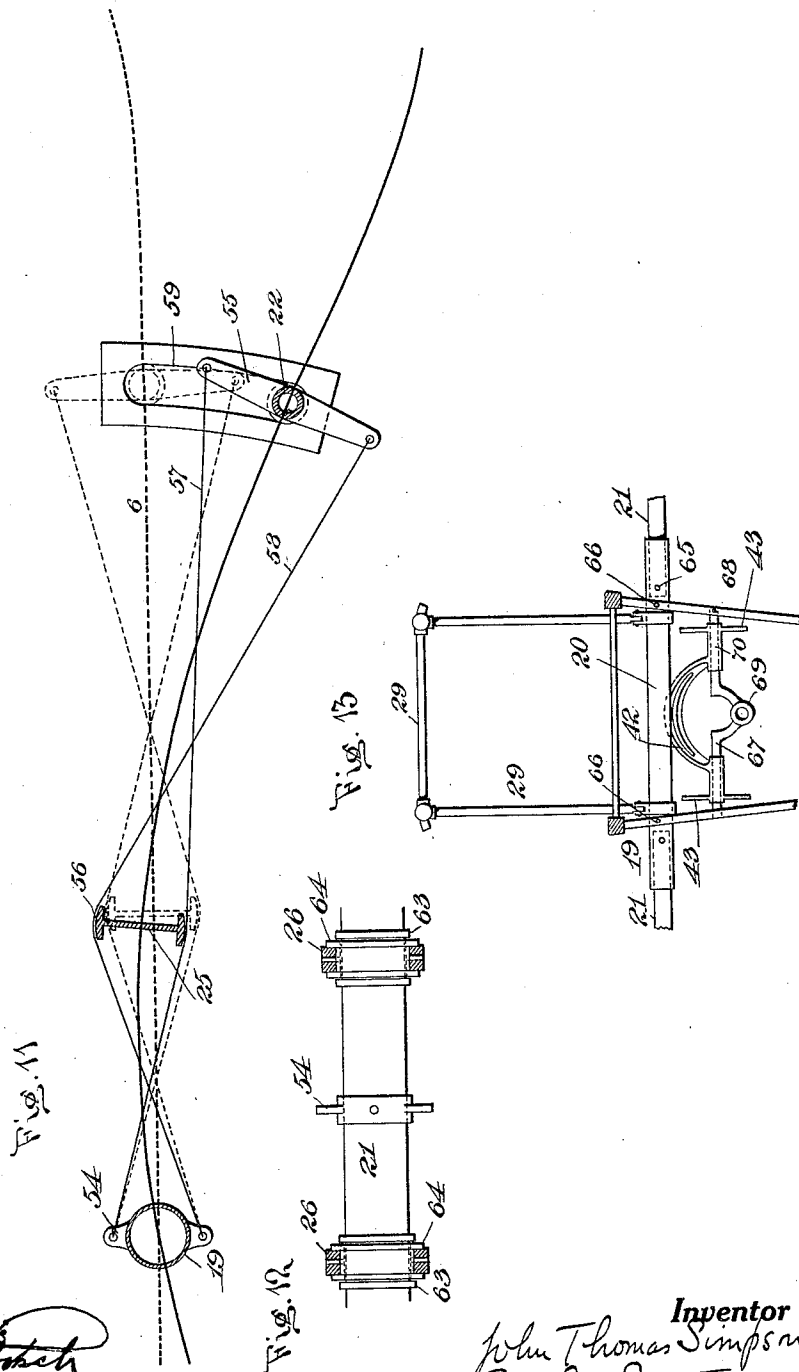
Fig. 10

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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

JOHN THOMAS SIMPSON, OF NEWARK, NEW JERSEY.

AEROPLANE.

1,098,131.

Specification of Letters Patent.

Patented May 26, 1914.

Application filed March 27, 1912. Serial No. 686,470.

To all whom it may concern:

Be it known that I, JOHN THOMAS SIMPSON, a citizen of the United States, and residing in Newark, in the county of Essex and State of New Jersey, have invented a certain new and useful Aeroplane, of which the following is a specification.

The objects I have in view are to produce a heavier than air flying machine, which will have the following advantages:

1. It will be so proportioned and the parts will be so relatively placed that the weights will be positioned well to the rear of the usual position, so that the center of gravity will be located on the approximate center of pressure of the main plane, which, so far as I am aware, is not done in any prior structures. The advantages resulting from this location of the center of gravity on the center of pressure, are principally that if the power gives out, or the propellers are stopped for any reason, the machine will not tilt suddenly forward, also it permits of a better control, especially on steep descents, and lessens the danger to pilot or passenger.

2. To produce an aeroplane in which the planes or wings may be removed so that the apparatus can be placed in a shed or hangar of less width than the spread of the machine from tip to tip. According to my invention, I make the planes so that they may be separated as entireties, without the necessity of being demolished, when they are taken away from the machine.

3. To produce a novel form of alighting apparatus, which will be simple and rigid and will take the shock of alighting, irrespective of the angle at which the machine settles.

4. To produce a machine in which the angle of incidence can be changed during flight. So far as I am aware, in machines heretofore suggested which have planes, the angle of incidence must be set before the machine leaves the ground. It is well understood that the angle of incidence must vary with the speed of the machine, consequently, machines intended for very high speed have to have a very small angle of incidence which sometimes reaches a negative value, hence before they can rise from the ground, or return thereto, they must be traveling at a high rate of speed, which is extremely dangerous.

5. To provide an aeroplane with a plane

in which the camber or curve of the plane may be altered in accordance with the angle of incidence. I find it extremely desirable to alter this camber in accordance with the angle that the aeroplane assumes to the horizontal. When the angle of incidence is slight, which is the case when the machine is traveling at a high rate of speed, the plane should be very flat. When the angle of incidence is great, as when the aeroplane is traveling at a low rate of speed, *e. g.*—is about to arise from the ground, or is about to settle,—the camber should be considerable, as the plane in this form is much more efficient in lifting power than when it is nearly flat.

6. To provide means for flexing or bending the planes for stabilizing, which will be very simple and effective and can be used with a structure in which the angle of incidence or camber of the planes is altered during flight, and in which the planes are removable from the frame.

7. To improve the mechanism for controlling the angle of incidence, together with stabilizing, and horizontal and vertical changes of direction.

These and further objects are attained by the mechanism illustrated in the following specification and accompanying drawings, considered together or separately.

In the drawings, Figure 1 is a plan view of the complete machine embodying my invention. Fig. 2 is a section on the line 2—2 of Fig. 1, looking in the direction of the arrow. Fig. 3 is a detail sectional view of the controlling lever for changing the angle of incidence and camber of the planes. Fig. 4 is a detail side elevation of a portion of the same mechanism. Fig. 5 is an enlarged elevation of the operative parts of the apparatus shown in Fig. 1. Fig. 6 is a detail of a plane showing it in the position of maximum angle and maximum camber. Fig. 7 is a similar view showing the plane in position of intermediate angle and camber. Fig. 8 is a similar view showing the plane in substantially horizontal position and with substantially negative camber. Figs. 9 and 10 are detail views of means for connecting the planes with the front spar. Fig. 11 is a diagrammatic view of a plane showing a modification. Fig. 12 is a detail view showing the means for attaching the plane of Fig. 11 to the front spar; and Fig. 13 is a front elevation of the front spar show-

ing the details of attachment of the same to the body of the machine.

In all of the views, like parts are designated by the same reference characters.

5 Referring more particularly to Figs. 1, 2 and 5, the frame 1 is preferably of the shape shown best in Fig. 1, so arranged as to lie between the two planes and carry the propeller at the front end and the rudders at the rear end. The frame is of such a size and shape that all of the mechanism, including the operator's seat, will be inclosed within it. The frame is provided with a depending skid 2 along its longitudinal center at the front. Adjacent to the skid, and on each side thereof, is a wheel 3. These wheels are connected to the frame by the spring axle 4, best shown in Fig. 2. In addition, shock absorbers 5, 5, connect the 10 wheels of the frame. This provides a means whereby, when alighting, the spring axle will be deflected, and the shock absorbers will be compressed before the skid touches the ground. When the device alights at an angle, the wheel which first strikes the ground will compress the absorber on that side and deflect that side of the spring axle, thus eliminating the shock of alighting.

The main plane 6 is in two parts,—one on each side of the frame. The horizontal rudder 7 is in two parts,—one on each side of the frame, as shown in Fig. 1, and the vertical rudder 8 lies at the extreme rear of the frame between the horizontal rudders. I prefer to make these rudders according to the disclosure contained in my co-pending application for patent, filed April 5, 1910, Serial No. 553,622.

Inside of the frame is the operator's seat 9, so that the operator will be above the machinery, but at the same time within convenient and easy reach of all control parts. Below the seat is the engine 10. Any form of engine may be used, that shown being solely for the purpose of illustration. The engine illustrated is in two parts,—each being independent of the other. The gasoline, oil and water tanks are disposed behind and below the seat of the operator. 10 By locating the tanks and engine in the places shown, particularly in relation to the main plane, as shown in Fig. 5, the center of gravity of the entire machine is well to the rear, and approximately below the center of pressure of the main plane. For this reason, when descending there is no tendency of the machine to dive downward, as is the case when the weights are farther forward.

60 The engine is connected to the propeller by means of a chain 12, which connects through a pawl device 13, mounted on a shaft 14. The pawl device illustrated is similar to that disclosed in my co-pending application for patent, filed August 22, 1911,

Serial No. 645,359. By this device, the two portions of the engine, when running at the same speed, will equally divide the load. Should one engine run faster than the other, that engine will take all of the load. This 70 is a simple device, whereby one of the engines can be stopped if desired, and all the work done by the other engine. The shaft 14 is provided with a friction clutch 15, which, through the agency of the chain 16, 75 rotates the propeller shaft 17. This propeller shaft 17 carries the propeller 18. I make no claim upon the location of the propeller or the details of the connections between the engines and the propeller in this 80 application, and the said details may be modified, as desired.

The main planes are supported upon the front spar 19, and on the rear spar about to be described. The front spar comprises 85 a center section 20, permanently attached to the frame 1, and end sections 21, 21, removably attached to the center section. The details of this attachment will be described later. The main planes are also supported 90 upon the rear spar 22, which comprises a center section 23 located within the frame and end sections 24 removably attached to the center section. Each plane includes, in addition, the intermediate spar 25 and the 95 ribs 26. These ribs, best shown in Figs. 6, 7 and 8, are formed of flexible material and have two ends connected together at the rear of the plane, and a loop portion passing around the front spar. The intermediate spar connects the upper and lower members of the ribs. The ribs and spars are inclosed by a cover 27. No details of the cover are shown herein, but a convenient and satisfactory form of cover is disclosed 105 in my co-pending application for patent, filed August 22, 1911, Serial No. 645,359. The center sections of the front and rear spars are connected together by hog frames 28. The two frames carry the cross-tube 29 110 (see Fig. 2).

The devices for stabilizing are as follows: I utilize an arrangement whereby one wing tip may be deflected downward, while the other wing tip is deflected upward, and vice versa. These devices include upper wires 115 30, attached to the wing tips, and passing through the cross-tube 29, as shown in Fig. 2. Lower wires 31 are attached to the wing tips, as shown in Fig. 2, and are connected 120 to a lever 32. This lever being moved from side to side by mechanism about to be described, it is apparent that it will pull down one wing tip through the wires 31, slackening the similar lower wires on the other side 125 of the machine and raising the opposite wing tip through the agency of the wires 31. The lever 32 is mounted upon a shaft 33 (see Fig. 5). The rear end of this shaft 130 is mounted in a slotted sector, so that it can

be raised or lowered to accommodate the movement of the plane when its angle of incidence is changed, as will be described. This shaft 33 is connected to the rear spar 22 by means of a distance bar 35. For the purpose of permitting rotation of the shaft 33 at any angle it may assume, it is provided with a universal joint 36, and the front end of the shaft is provided with a yoke 37. This yoke is connected by mechanism whereby the operator can twist the shaft 33 and flex the desired wing tip. This mechanism is operated by a shaft 38, which carries the steering wheel 39. The shaft is so mounted that it may be swung from side to side. At a point intermediate its ends, it is connected to wires 40, the other end of the wires being connected to opposite ends of the yoke 37. The shaft 38 is provided with a universal or knuckle joint, and is connected to a drum 41. This drum is connected by suitable wires to the vertical rudder 8. This is described in my co-pending application for patent, filed August 22, 1911, Serial No. 645,359. I also disclose herein a device similar to that described in that application, whereby the shaft 38 can be utilized to actuate the horizontal rudders 7. This device comprises a slotted sector 42. The shaft 38 passes through the slot, as shown in Fig. 5. The sector is connected to a pair of yokes 43. These yokes are connected to the horizontal rudders 7, 7, by the wires shown in Fig. 1.

For the purpose of changing the angle of incidence of the planes, while the machine is in operation, I provide the following mechanism: The rear spar 22 is connected to a chain 44. This chain is preferably in duplicate, one being located on each side of the body. I will describe one chain and its attendant mechanism, as the other (when employed) will be the same. This chain passes over sprocket wheels 45 above and below the spar, as shown. A second chain 46 actuates the sprocket wheel 45, by means of a second sprocket wheel on the same shaft. This chain 46 is actuated by a sprocket wheel 47, best shown in Fig. 4. The sprocket wheel 47 turns with a spur gear 48, which is actuated by a spur sector 49. This spur sector is carried on a lever 50. This lever is bent to one side so as to clear the operator's knee, as shown in Fig. 3. It has the usual pawl, which engages with a toothed sector 51, carried on the frame of the machine. The center section 23 of the rear spar passes through the curved sector 52 carried upon the frame, and its position is thereby determined. In order to support this center section, it is mounted in a slotted plate 53. It is apparent that by moving the lever 50 forward or backward, the rear spar will be elevated or depressed.

By using a sector 49 of the shape shown, en-

gaging with the lower side of the spur gear 48, I am enabled to provide a movement which agrees with the instinctive movements of the operator, as arranged and shown in Fig. 4. When the lever 50 is moved forward, the rear end of the plane is elevated. When the plane tends to descend, the instinctive movement of the operator is to lean backward. This will pull the lever 50 toward him, and will have the effect of depressing the rear end of the plane, which will have a tendency to cause the machine to rise.

A very important feature of my invention resides in means for changing the camber of the main plane as the angle of incidence is changed. Referring to Fig. 6, the plane is shown at its approximately maximum angle of inclination, and with its approximately maximum extent of camber. This is for use when the machine is about to rise from the ground and is traveling at low speed. When it is traveling at high speed, the angle of incidence should be greatly reduced, as shown in Fig. 8. At the same time I provide devices which reduce the camber so that the plane more nearly approaches a true plane. An intermediate position is shown in Fig. 7. Where the angle of incidence is slightest, the camber will be lowest. This change of camber is attained by flexing the plane in a longitudinal line. The mechanism, by means of which this is accomplished, is best shown in Figs. 4, and 6 to 9, inclusive. Referring more particularly to Fig. 6, a front yoke 54 is attached at the proper position on the front spar 19. A rear yoke 55 is attached, immediately behind the front yoke, to the rear spar, and also to the ribs of the plane. Two sliding abutments 56 are provided on the upper and lower surfaces of the plane in line with the two yokes. These abutments may conveniently be rounded extremities of the intermediate spars 25. The upper extremities of the two yokes are connected together by an upper wire 57, which passes around and under the lower abutment. The lower extremities of the two yokes are connected together by a lower wire 58, which passes around the upper abutment. These wires are kept under tension by suitable devices (not shown). It is apparent,—the front yoke 54 being fixed,—that if the rear yoke 55 is turned upon its axis it will put a pulling stress upon one of the wires 57 or 58. The stress exerted by this wire against the abutment which it passes over will tend to flex or bend the plane. Various devices may be used for twisting or turning the rear yoke. If the parts be arranged as shown in Fig. 6, and the rear spar be elevated or depressed, it is apparent,—the front yoke being fixed,—that the angle that this yoke bears to the center line of the plane will vary in accordance with the angular po-

sition of the plane; consequently, one or the other of the wires will have stresses imparted to it which will result in flexing the plane in the proper direction. I prefer, however, to positively twist or turn the rear yoke, and to do so by twisting or turning the rear spar as the same is elevated or depressed. The mechanism for accomplishing this is best shown in Fig. 4. On the frame is provided the double curved track 59. This track is preferably arranged adjacent to the curved sector 52. The slotted plate 53 is provided with wheels which engage with this track. The center section 23 of the rear spar is provided with a rectangular block 61. This block is placed within a slot 62 in the slotted plate. The shape of the tracks 59 is such that as the slotted plate is elevated or depressed, the block 61 will be twisted and will, in turn, turn the center section 23 upon its axis. The slot 62 allows the tracks to be so located that they are not coincident with the curved sector 52.

In order to support the front end of the ribs of the plane, the front spar is provided with collars 63, in which the ribs 26 play. The ribs are not attached to the collars, and, consequently, have fore and aft movement, as clearly shown by a comparison of Figs. 6 and 8. This is necessary, to accommodate the changing distance between the front and rear spars as the camber of the plane changes. The curved sector 52 must be so shaped that the rear spar is kept at the proper distance from the front spar at all angles of the plane, so that the upper and lower wires 57 and 58 are kept under proper tension. According to this embodiment of the invention, it is apparent that the rearward stresses of the plane are resisted entirely by means of the rear spar. As, however, only the center portion of the plane is flexed, and the tip portion is of uniform curvature, the ribs toward the wing tips may be permanently attached to a collar or annulus on the front spar. Such a collar or annulus is shown in Fig. 12. In this figure, the annulus 64 is mounted between the collars 63, and the ribs are attached to the annulus by means of a pin. In the modification shown in Fig. 11, this manner of attachment of the rib may extend through the entire length of the plane. This is made possible by so shaping the curved sector 52 that the distance between the plane varies according to the curvature or camber of the plane, and at the same time the curved track 59 is so shaped that the rear spar is twisted at such an angle that both upper and lower wires are kept under proper tension, irrespective of the amount of camber in the plane. Fig. 13 shows the device for supporting the front spar, and also the shaft 38. The center section 20 is secured to the section 21 by the pin 65, so that the planes can be

removed when the machine is placed in the hangar, or is being transported. Fig. 13 illustrates as to this detail a structure before described in connection with the other figures. Referring again to the illustration in Fig. 13, the center section 20 is secured to the frame 1 by suitable means, as pins 66, so that it will not rotate. A support 67, mounted in bearings 68, carries a bearing 69 for the front end of the shaft 38.

Mounted on the support 67 is an interrupted tube 70, which carries the yokes 43 and the sector 42.

It will be apparent from the foregoing description that an aeroplane constructed in accordance therewith, having devices which permit the angle of incidence and the camber of the supporting plane to be changed at will while the machine is in the air, will reduce the resistance for fast speed and will yet provide a safe means for leaving and returning to the ground. A great advantage of this arrangement—particularly that of the adjustable angle of incidence—is that it can be used to assist in righting the machine while it is making a steep descent. It is apparent that, if the plane be set at a flat angle of incidence while the machine is descending, by changing the angle of incidence it would have a tendency to raise the nose or front end of the machine and bring it to an even keel. This I regard as of great importance, as there have been accidents to aviators which, I believe, could have been avoided if the machine had been built so that the angle of incidence could have been changed when they found that they had misjudged their distance from the ground and the rear elevator was too small to right the machine suddenly.

A great advantage of locating the weights as I have described, is particularly apparent when the machine is planing down from a height. In this situation, the nose or front end of the machine will be lower than the tail. This will cause the center of pressure on the main plane to shift back toward the trailing edge of the same. In prior constructions, with the engine mounted on or adjacent to the nose of the machine, this would give an overturning moment, due to the increased length of the lever arm between the center of pressure, when the machine is flying on a level line, and the center of pressure when the machine is planing down at a steep angle. By locating the engine, tanks, pilot, and as much of the heavy part of the machine as is possible, on the approximate line of pressure, this increase in the lever arm is practically nil. This I regard as of great importance in the design of the apparatus, particularly when planing down and flying with the wind, the tendency of which is to catch under the tail and throw the machine over.

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A particular advantage of the landing gear described, using the laminated spring and shock absorber, is that it not only takes the shock due to landing, but also provides
5 against side thrust. For this reason, the shock absorber is located where it is shown and described, so as to communicate the stress directly from the wheel to the rigid part of the body, thus practically bracing
10 against the heavy weight of the body when a landing is made.

In accordance with the provisions of the patent statutes, I have described the principle of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is merely illustrative and that the invention can be carried out in other ways.

15 Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. An aeroplane having a plane supported to turn around an axis, yokes on the plane
25 at a distance apart, abutments between the yokes and wires connecting the yokes and engaging with the abutments, and means for varying the angular relation of the yokes to change the camber of the plane.

30 2. An aeroplane having a plane supported to turn around an axis, yokes on the plane at a distance apart, abutments between the yokes and wires connecting the yokes and engaging with the abutments, means for
35 varying the angle of incidence of the plane, and means for varying the angular relation of the yokes to change the camber of the plane.

3. An aeroplane having a body, a main
40 plane, said main plane being pivoted to turn around a point adjacent to its forward edge, so that the angle of incidence may be changed, a shaft, manual devices for turning the shaft, a distance bar connecting the shaft
45 to the plane so that the two are kept in parallelism, during the turning operation, and connections between the shaft and the plane, for distorting the rear edge thereof.

4. An aeroplane having a body, a main
50 plane, a shaft connected to the body, said shaft being substantially parallel to the main plane, means for changing the angle of incidence of the main plane, means for maintaining the shaft parallel to the plane, during
55 the turning operation, means for operating the shaft, and connections between the shaft and the plane, for distorting the rear edge thereof.

5. An aeroplane having a body, a main
60 plane pivoted thereto, a shaft parallel to the main plane, a distance bar connecting the two, keeping them parallel irrespective of the position of the plane, and during the turning operation, a lever on the shaft,

manual devices for rotating the shaft, and
65 wires connecting the lever to the plane, for distorting the latter.

6. An aeroplane having a body, a main plane pivoted thereto, on both sides thereof, a shaft parallel to the plane, manual devices for rotating the shaft, a distance bar
70 connecting the shaft to the plane, a lever on the shaft, wires connecting the lever to the plane, on both sides of the body, a hog frame above the plane, wires connecting the
75 plane on opposite sides of the body, said wires connecting the rear edges of the plane, and said wires also engaging with the said hog frame.

7. An aeroplane having a body, a plane
80 on both sides of the body, said plane being capable of turning about an axis adjacent to its forward edge, a spar connected to the rear part of the plane, a slotted plate connected to the spar, means for moving the
85 slotted plate in a vertical direction, and means for twisting the slotted plate so that the spar is rotated.

8. An aeroplane having a body, a plane
90 on both sides thereof, turning about an axis adjacent to its forward edge, a rear spar, a slotted plate connected to the spar, a sector connected to the body and engaging with the slotted plate, a sector slot on the body and engaging with the spar, the curves of
95 the sector and the sector slot being different, so that as the slotted plate is moved in the sector, the spar will be turned at an angle owing to the twisting of the slotted plate.

9. An aeroplane having a body, a main
100 plane on both sides thereof, said plane having a spar, a curved slot in the body, through which the spar passes, a rectangular block on the spar, a slotted plate engaging with the block, a sector on the body and engaging
105 with the slotted plate, the curve of the sector being different from that of the curved slot, and means for elevating and depressing the slotted plate.

10. An aeroplane having a body, a main
110 plane on both sides thereof, said plane having a spar, a curved slot in the body, through which the spar passes, a rectangular block on the spar, a slotted plate engaging with the block, a sector on the body and engaging
115 with the slotted plate, the curve of the sector being different from that of the curved slot, means for elevating and depressing the slotted plate, a chain engaging with the slotted plate, and means for moving the chain.
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11. An aeroplane having a body, a main plane on both sides thereof, said plane having a spar, a curved slot in the body, through which the spar passes, a rectangular block on the spar, a slotted plate engaging
125 with the block, a sector on the body and engaging with the slotted plate, the curve of the sector being different from that of the

curved slot, means for elevating and depressing the slotted plate, a chain engaging with the slotted plate, means for moving the chain, a sprocket engaging with the chain, 5 and a chain engaging with the sprocket, for moving the latter.

12. An aeroplane having a body, a pilot's seat thereon, a plane on both sides thereof, means for raising or depressing the rear 10 edge of the plane, said means including a toothed sprocket, a lever, a toothed sector carried by the lever and turning a toothed wheel, carried by the sprocket, said lever being adjacent to the pilot's seat and bent 15 to one side, to clear the pilot's knees.

13. An aeroplane having a body, a pilot's

seat thereon, a plane on both sides thereof, means for raising or depressing the rear edge of the plane, said means including a toothed sprocket, a lever, a toothed sector 20 carried by the lever and turning a toothed wheel, carried by the sprocket, said lever being adjacent to the pilot's seat and bent to one side to clear the pilot's knees, and a sector carried by the body and engaging with 25 and locking the lever.

This specification signed and witnessed this 13th day of March, 1912.

JOHN THOMAS SIMPSON.

Witnesses:

PAULINE WESTRUP,
S. CONOVER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."