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T. P. LEAMAN.

AIRPLANE.

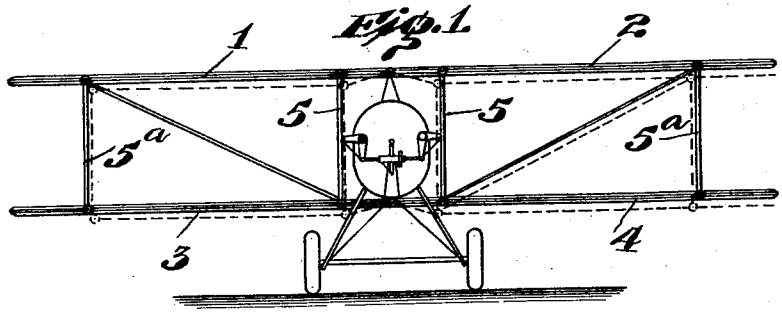
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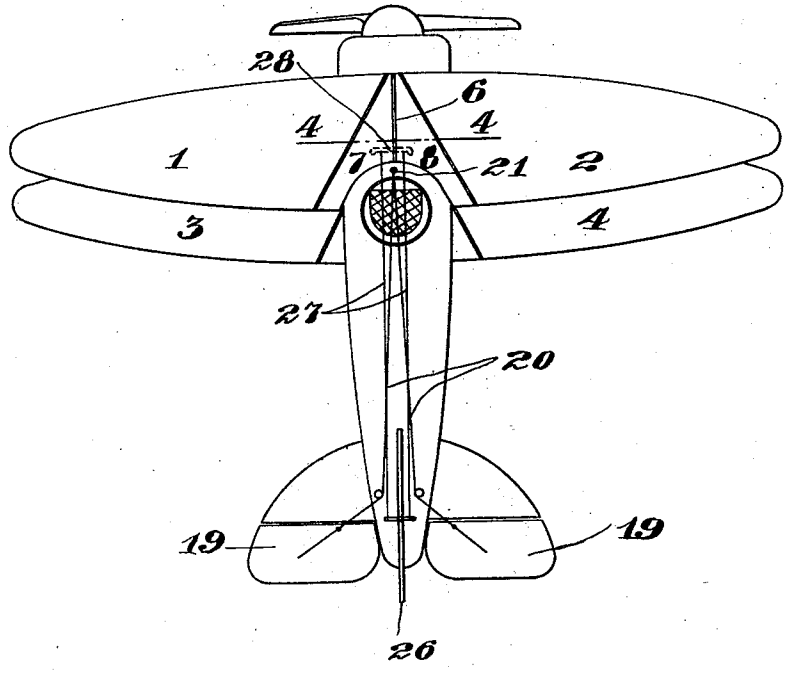
2 SHEETS—SHEET 1.

Fig. 1.



X 108

Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

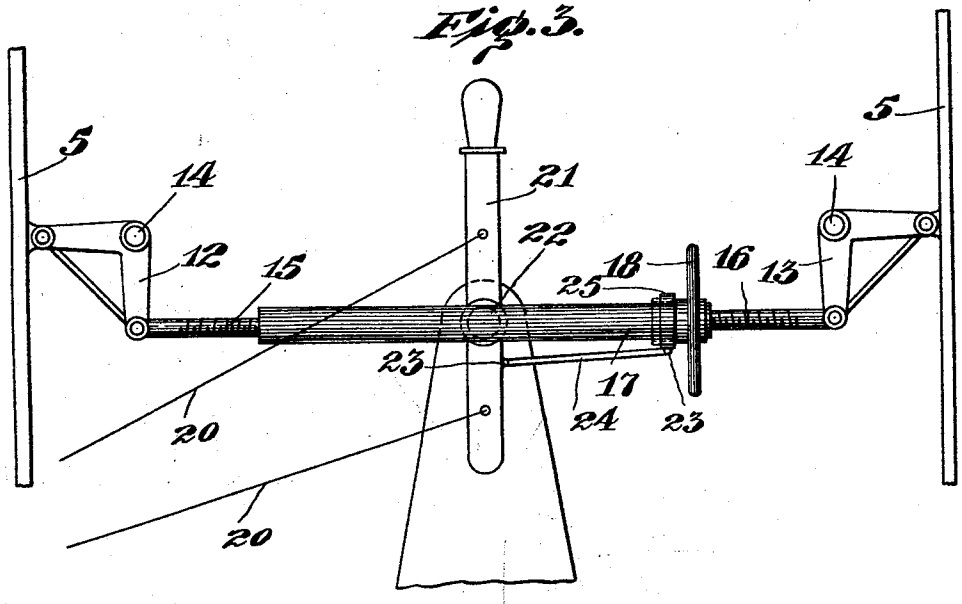


Fig. 4.

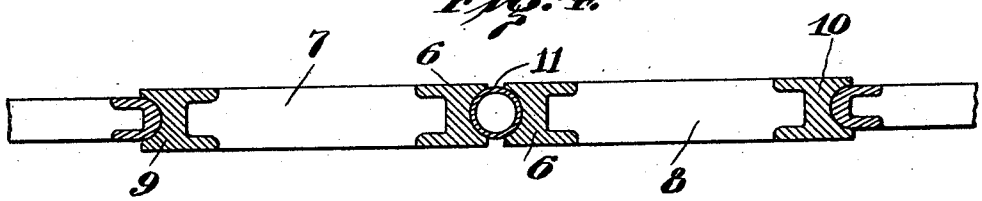
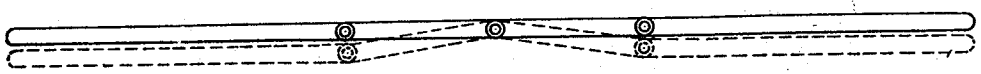


Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS P. LEAMAN, OF ITHACA, NEW YORK.

AIRPLANE.

1,304,525. Specification of Letters Patent. Patented May 20, 1919.

Application filed July 1, 1918. Serial No. 242,725.

To all whom it may concern:

Be it known that I, THOMAS P. LEAMAN, a citizen of the United States, and resident of Ithaca, in the county of Tompkins and State of New York, have invented certain new and useful Improvements in Airplanes, of which the following is a specification.

This invention relates to airplanes, and my improvements are directed to a novel means of mounting the main supporting wings or aerofoils so that they may be controlled to vary their angle of incidence, whereby in horizontal flight, a flatter angle may be provided for high speeds; while for making landings, and for rising, as also for lateral control the wings may be given varying positive and negative angles.

Different methods have been tried whereby the main supporting wings of airplanes are mounted for movement to variable degrees of angularity, but the object sought in my present invention is that of providing a joint whose engagement extends over a substantial extent of the wing chord, in the interest of strength and rigidity, and in imparting to said joint a compound flexure; in order that, when the wings are moved upon their hinges, to vary their angle of incidence, they will not necessarily shift out of the horizontal plane normally occupied by their span or spread. In other words, if the normal span of the wings be flat, or with a given dihedral, the same may be undisturbed through the movements of said wings about their joint.

In brief, the compound wing joint I have devised consists of a central, longitudinally disposed hinge and a pair of angularly disposed hinges engaging the butt ends of a pair of wings, which converge at one end of said central hinge, and together inclose a triangle which is bi-sected by said central hinge. By means of this compound joint, the wings, in flexing, may turn upwardly or downwardly around the central hinge, at the same time turning equally in the opposite direction upon the outer, inclined hinges, to remain, with the new angle of incidence, in substantially the normal plane of their span.

Suitable control means are provided whereby the right and left wings are moved in synchronism.

Variation of speed.

It will be evident from the foregoing that if the opposite surfaces are simultaneously raised or lowered, through the medium of the compound joint, their respective angles of incidence are decreased or increased, thus providing a means for varying, during flight, the horizontal speed of the machine.

Lateral control.

It is also evident, that if one wing be raised while the opposite is lowered (by means of the compound joint) the angle of incidence of one wing will be increased while that of the opposite wing decreases or becomes negative. This provides a simple and very powerful means for lateral control.

Longitudinal control.

Longitudinal control may be performed through the tail elevators, by means of cables leading to a universally mounted "joy stick".

Directional control.

Directional control may be through the conventional foot bar connected by cables to a vertical rudder.

Other features and advantages of my said invention will hereinafter appear.

Figure 1 is a rear elevation of a bi-plane embodying my improved jointed wings.

Fig. 2 is a top plan view thereof.

Fig. 3 is a detail of control mechanism for the jointed wings and the tail wings.

Fig. 4 is an enlarged section through the line 4—4 of Fig. 2, and

Fig. 5 is a rear edge view of the wings (when the angular hinges converge forwardly) showing in full lines the normal position thereof, and showing the joints flexed (in dotted lines) for an increased angle of attack.

My improvement is here shown as applied to a bi-plane, but it is equally applicable to monoplanes or multiplanes.

The bi-plane illustrated has the upper wings 1, 2; lower wings 3, 4, and connecting struts 5, 5ª, which latter have pivotal engagement with the wings, as by ball and socket joints.

The central portion of the supporting surface of both upper and lower wing spreads is in the form of a plane triangle whose base is included in the rear edge of said surface, and its vertex in the leading edge; and said central portion is divided centrally, by a longitudinally extending hinge 6, into the triangles 7, 8, whose outer edges respectively, oppose, and engage by hinged connections the butt ends of the wings.

For convenience, in the following description, the wings 1 and 3 may be referred to as the left wings, and the wings 2 and 4 as the right wings.

An example of means for effecting the hinge connection is shown in the enlarged, sectional view of Fig. 4, indicating the central hinge 6, and the forwardly converging hinges 9 and 10, at opposite sides thereof. The hinge 6 is formed about a rigidly mounted shaft 11, upon which the portions 7, 8, may turn; while, the left and right wings may, respectively, turn about the hinges 9 and 10.

Since it is my purpose, in providing the compound joint aforesaid, to effect changes of incidence angularity through chord-wise flexure, I cause the portions 7, 8, to be turned upon hinge 6 oppositely to the turning movement of the left and right wings, whereby the desired result is achieved.

Therefore, rear struts 5 are engaged with the hinges 9, 10, near the rear ends of the latter, and the flexure of the compound joint is accomplished by moving said struts up or down.

Should the portions 7, 8, be thus turned downwardly, then, bearing in mind that the upper and lower wings are trussed together, and each provided with corresponding joints, it will be apparent that while the rearward edge of the wings will be depressed, the leading edge will remain stationary, or, according to the degree of motion imparted, will tend to slightly increase in dihedral. If, on the other hand, the portions 7, 8, are turned upwardly, then the opposite effect will result; the rear edge rising, and the leading edge remaining stationary, or with a tendency toward a cathedral angle. The movements aforesaid are of course rendered possible by reason of the jointed connections between the struts and wings. By these movements the wings have imparted to them the desired changes in incidence angularity, as for lateral control and for varying the speed of flight.

The control means illustrated herein, whereby the wings are moved, consist of bell-cranks 12, 13, journaled on fixed pivots 14, and having pivotal connection with the struts 5. Said bell-cranks engage, respectively, with left and right threaded rods 15, 16, that enter oppositely threaded ends of a tube 17, which is provided with a hand-wheel 18, for rotation.

Upon turning the hand-wheel in one direction the rods 15, 16, will be drawn inwardly, thereby causing the struts 5 to be lowered. This action will depress the rear edges of the wings, as shown in dotted lines, Figs. 1 and 5, and thereby increase the attacking angle. Whereas if the hand-wheel be turned in the opposite direction the rear edges of the wings will be raised and correspondingly decrease the attacking angle or render it neutral or negative, according to the degree of movement employed.

The above operation is utilized for changing the angle of incidence in flight, and consequently varying the speed and climb of the machine.

For lateral control the "joy stick" 21 is connected through universal joints 23, and link 24, to a collar 25, said collar being capable of revolving about tube 17 but incapable of sliding thereon. Lateral motion of the joy stick 21 will therefore cause tube 17 to be displaced laterally, which action, through the bell cranks 14, will cause one strut 5 to move downwardly, while the opposite strut 5 moves in an upward direction, thus increasing the angle of incidence of the wings on one side of the machine, while the angle of the wings on the opposite side is reduced a like amount. This action produces a strong righting moment for lateral control.

For longitudinal control the "joy stick" 21 is connected to tail elevators 19 by cables 20 in the conventional manner.

Directional control is imparted by a vertical rudder 26, which is operated by cables 27, leading to a foot bar 28, as in current practice.

Variations may be resorted to within the spirit and scope of my said invention and parts thereof used without others.

I claim:—

1. An airplane having supporting wings engaged by co-acting longitudinal and angular chordwise hinges, whereby said wings are movable to variable angles of incidence substantially without change in lateral angularity.

2. An airplane having supporting wings engaged by co-acting longitudinal and angular chordwise hinges, whereby said wings are movable to variable angles of incidence substantially without change in lateral angularity, and control means for said wings.

3. The combination, in an airplane, of right and left supporting wings therefor,

movable to variable angles of incidence, a central chordwise connecting hinge for said wings, and chordwise hinges of opposite angularity at the respective sides of said central hinge.

4. The combination, in an airplane, of right and left supporting wings therefor, movable to variable angles of incidence, a central chordwise connecting hinge for said wings, chordwise hinges of opposite angularity at the respective sides of said central hinge, and control means for said wings.

Signed at Ithaca in the county of Ithaca and State of New York this 10th day of June A. D. 1918.

THOMAS P. LEAMAN.

Witnesses:
F. W. BARKER,
A. B. BARKER.

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