R. ESNAULT-PELTERIE.

AEROPLANE.

APPLICATION FILED JULY 14, 1909.

1,024,929.

Patented Apr. 30, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

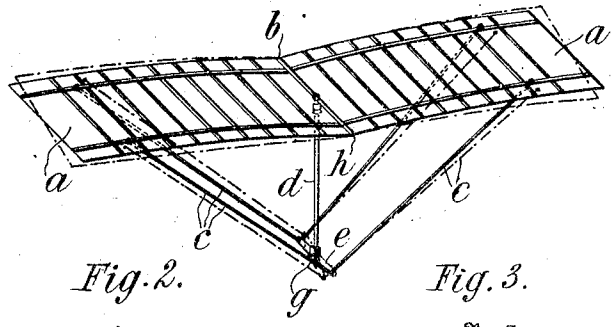


Fig. 2.

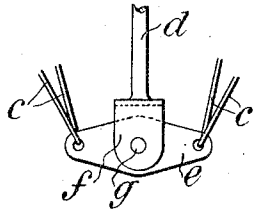


Fig. 3.

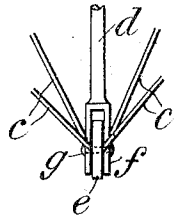


Fig. 4.

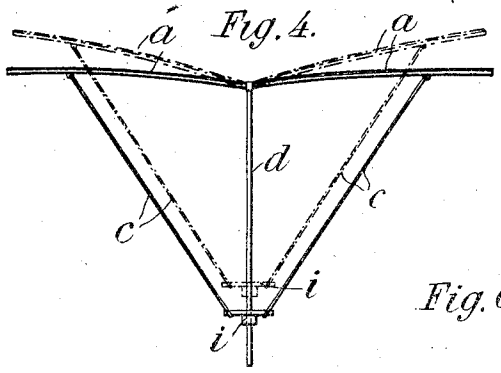


Fig. 5.

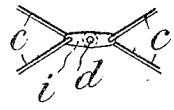
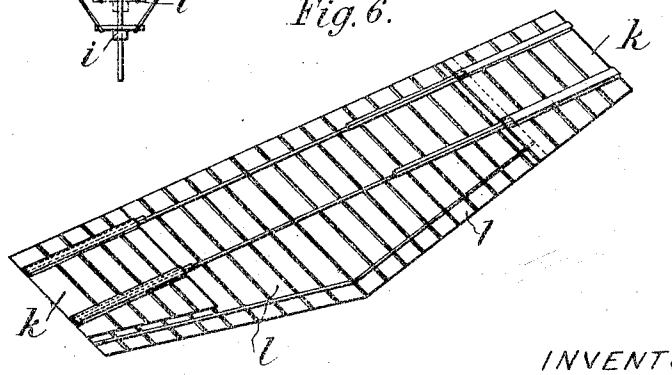


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 8.

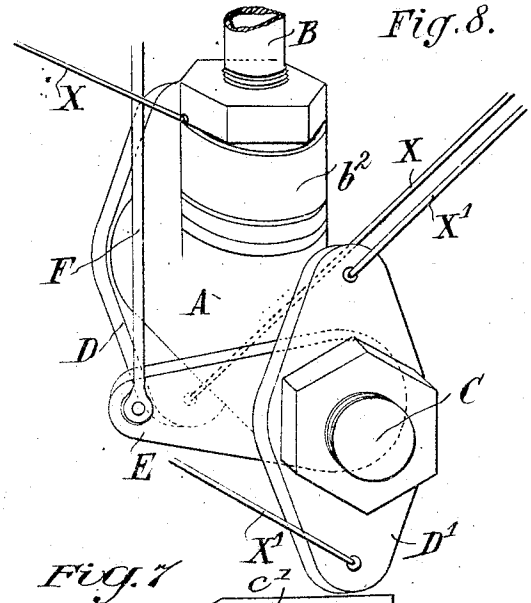


Fig. 7.

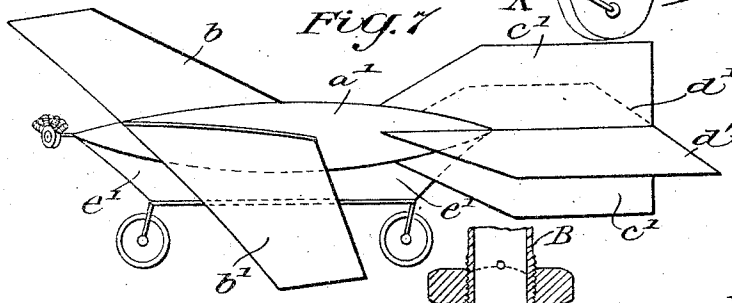
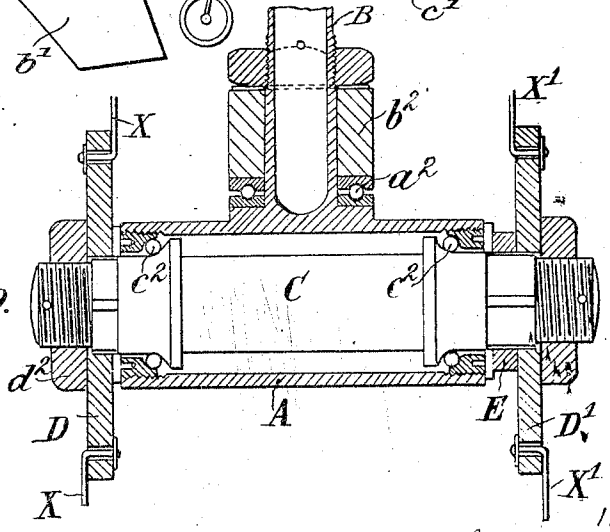


Fig. 9.



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AEROPLANE.

1,024,929. Specification of Letters Patent. Patented Apr. 30, 1912.

Application filed July 14, 1909. Serial No. 507,576.

To all whom it may concern:

Be it known that I, ROBERT ESNAULT-PELTERIE, a citizen of the Republic of France, residing in Billancourt, Seine, France, have invented certain new and useful Improvements in Aeroplanes, of which the following is a specification.

This invention relates to an aeroplane in which the sustaining planes are adapted to be bent for varying their sustaining power.

As is known, the sustaining power must vary in accordance with the speed of travel of the aeroplane and in such a manner that the machine may remain at the same level in the air or may ascend or descend.

By combining in an aeroplane the variation of the sustaining power with the variation of the tractive or propelling force of the machinery the level of travel can be changed and the speed modified, that is to say, the maneuvering powers of the aeroplane are augmented.

One of the simplest means for varying the sustaining power of the planes is to vary their incidence by causing them to turn around horizontal transverse axes on which they are mounted. I have already indicated how this may be done in the case of rigid planes; but the principle may also be applied to flexible planes in order to utilize at the same time the bending of the planes which occurs as a necessity.

With reference to the accompanying drawings there are described different means for obtaining the variation of the sustaining power of the flexible planes in accordance with this invention.

Figure 1 is a diagrammatic perspective view of an aeroplane and means for flexing the same. Figs. 2 and 3 are respectively side and end views of a detail of the flexing means shown in Fig. 1. Fig. 4 is an illustration of a modification of the construction illustrated in Fig. 1. Fig. 5 is a view of a detail of the flexing mechanism illustrated in Fig. 4. Fig. 6 illustrates a modification of the supporting surface illustrated in Fig. 1. Fig. 7 is a diagrammatic perspective view of my complete flying machine. Figs. 8 and 9 are respectively a perspective and a cross section view of a detail of a modified form of flexing means.

On Fig. 1 is a diagrammatic perspective view of a flexible plane $a\ a$ articulated to a chassis at the middle of the machine. The shrouds c, which are attached to the wings near the outer extremities of the latter, are connected with the vertical rod d placed at the middle under the wings, through a short bar e, pivoted in a fork f at the lower end of the rod d. The latter can be turned on its vertical axis so as to bend or warp the wings reversely as hereinafter described when this is desirable; on the other hand by turning the bar e, represented in side view and end view respectively in Figs. 2 and 3, on its pivot g in such a manner as to incline it downward toward the rear; the rear portion of the extremities of the wings h are lowered and the forward portions are allowed to rise in such a manner that the planes take the position indicated in dotted lines in Fig. 1. There is thus obtained the variation of incidence necessary for ascending or for descending or for diminishing the speed.

The mode of varying the incidence which has just been described is also applicable to multi-plane machines whether the planes are superposed or not.

The arrangement shown diagrammatically in end view in Fig. 4 is for the purpose of converting the plane more or less into a dihedron so as to reduce the bearing surface of the wings, if desired. It consists in attaching the lower ends of the shrouds to a piece i, represented in side view and in plan respectively in Fig. 5, sliding on the vertical rod d situated beneath the wings. By sliding the piece i up or down the rod, the desired dihedral form can be given to the plane.

Fig. 6 shows diagrammatically a pair of wings each having an extreme portion k forming a shutter, which can be rendered of no effect by sliding it on the main part l. On the right hand side of Fig. 6 is shown a wing with the shutter extended while on the left hand side the shutter is withdrawn. In this manner the bearing surface of the wing can be increased or diminished according to the speed with which the aeroplane travels.

Fig. 7 shows diagrammatically an aeroplane constructed according to this invention which is not provided with a rudder; at the rear is a fixed tail consisting of two planes intersecting each other at right angles, one plane being normally vertical and the other horizontal.

At the forward part of the cigar shaped body a^1 are attached the two flexible wings

b b^1; at the rear part are fixed the intersecting planes, the vertical plane being marked c^1 and the horizontal plane d^1. Beneath the body is a vertical surface e^1 playing the part of a keel to give transverse stability.

The apparatus operates as follows:—It may be supposed that in order to reëstablish transvers equilibrium the wings b^1 are bent in such a manner as to lift the forward part of the left wing and to depress the forward part of the right wing. This causes the aeroplane to be retarded on the left, which in consequence of the greater resistance offered by the left wing will cause the aeroplane to tend to turn toward the right. But in the act of turning, the vertical surface C^1 of the rear intersecting planes or appendage will be presented to the relative current of air and will receive a thrust or push in opposition to the direction of turning, thus correcting the tendency of the aeroplane to turn during the stabilizing operation. To turn the machine about, the side to which it is to be turned is first inclined, and for this purpose, for example if the turn is to be to the right, there is produced suddenly an incidence on the opposite side by bending the wings so as to have a sustaining component greater on the right hand than on the left hand. The apparatus then inclines toward the left, turning slightly toward the right. By bringing back the wings to their normal position the apparatus tends to continue in a straight line but as it is inclined to the left the horizontal component of the sustension makes it deviate by causing it to turn sidewise; the left wing then having less speed than the right wing should also be bent to augment its incidence and to prevent the apparatus from completely turning over toward the center of the circle described. From this moment the bending must be the inverse of the preceding bending for executing the turn; then when the turning is complete the bending is exaggerated in the same direction and the machine is righted and continues its path in a straight line. To facilitate ascent or descent of the machine the horizontal plane of the rear intersecting plane may be made to turn about a transverse horizontal axis; this plane then acts as a rudder for varying the depth of travel in the air. A separate rudder for this purpose may be arranged at the rear of the machine, or there may be one at each end.

Another manner to produce separately or simultaneously the bending of the wings and the variation of incidence will now be described. Fig. 8 is a perspective view of the bearing to which the shrouds are attached, Fig. 9 is a section thereof. This bearing is composed of a socket A fixed to a hollow rod B which can turn on a ball bearing a^2 and is guided through a projection b^2. Inside of this socket A is an axis C which is rotated in this socket with ball bearings c^2; the axis carries at one end a double arm D fixed thereon accurately for example by means of the nut d^2. The other end of the axis C carries also a second arm D^1 parallel and similar to the former; both these arms D and D^1 are moved by a lever E actuated by a rod F. On each double arm D or D^1 and at each extremity is attached one of the four wires or shrouds X and X^1 which produce the bending or deformation of the carrying surfaces or wings. The left front shroud X and the left back one X^1 are attached, the former to the superior extremity of the arm D the second one to the inferior extremity of the arm D^1; also the other shrouds of the right side, X and X^1, are reversed. It results thereof that, when the aviator turns the rod B to the left, the right shroud X^1 and the left shroud X will be put in tension and the other shrouds will be relaxed. The reverse bending of the wings is then obtained; the variation of the incidence is on the contrary effectuated by pulling on the rod F which turns the arm E and the arms D and D^1 so that the rear shrouds X X^1 are tensioned and the front shrouds relaxed. The incidence is thus increased, the inverse operation causes the decrease of the incidence.

By combining the rotation of the rod F and the rotation of the lever E, it is possible to cause simultaneously the reverse bending and the variation of incidence and thus the restoration of the longitudinal and transverse equilibrium of the aeroplane.

Having thus described my invention and the best means I know of carrying the same into practical effect, I claim:

1. In an aeroplane, the combination of a supporting surface and means for varying the incidence of said supporting surface simultaneously on both sides of the longitudinal axis thereof or varying the incidence thereof on one side of said axis relatively to that on the other side, said means comprising a rotatively mounted rod and a cross piece rotatively mounted on said rod, and connections between the ends of said cross piece and said supporting surface, movement of said rod operating to vary the incidence of said supporting surface on one side of its longitudinal axis relatively to that on the other, and separate movement of said cross piece operating to vary the incidence of said supporting surface simultaneously on both sides of said axis.

2. In an aeroplane, the combination of a supporting surface and means for varying the incidence of said supporting surface simultaneously on both sides of the longitudinal axis thereof or varying the incidence thereof on one side of said axis relatively to that on the other side, said means comprising a rotatively mounted rod, hav-

ing a cross arm upon one end and cross pieces pivotally mounted on the ends of said cross-arm, and connections between said supporting surface and the ends of said cross-pieces, movement of said rod operating to vary the incidence of said supporting surface on one side of its longitudinal axis relatively to that on the other, and separate movement of said cross piece operating to vary the incidence of said supporting surface simultaneously on both sides of said axis.

3. In an aeroplane, the combination of a supporting surface and means located in the medial plane of the aeroplane and beneath the supporting surface for varying the incidence of said supporting surface simultaneously on both sides of the longitudinal axis thereof or varying the incidence thereof on one side of said axis relatively to that on the other side, said means comprising a part having rotary movement in two planes, and connections between said part and said supporting surface, movement of said part in one plane operating to vary the incidence of said supporting surface simultaneously on both sides of its longitudinal axis and movement of said part in its other plane operating to vary the incidence of said supporting surface on one side of said axis relatively to that on the other, and an appendage in the form of intersecting horizontal and vertical planes.

4. In an aeroplane, the combination of a supporting surface and means for varying the incidence of said supporting surface simultaneously on both sides of the longitudinal axis thereof or varying the incidence thereof on one side of said axis relatively to that on the other side, said means comprising a rotatively mounted rod and a cross piece rotatively mounted on said rod, and connections between the ends of said cross piece and said supporting surface, movement of said rod operating to vary the incidence of said supporting surface on one side of its longitudinal axis relatively to that on the other, and separate movement of said cross piece operating to vary the incidence of said supporting surface simultaneously on both sides of said axis, and an appendage in the form of intersecting horizontal and vertical planes.

In witness whereof I have hereunto signed my name this 2nd day of July 1909, in the presence of two subscribing witnesses.

ROBERT ESNAULT-PELTERIE.

Witnesses:

MARCEL ARMENGAUD, Jeune,

DEAN M. MASON.