J. ASHWORTH.

AEROPLANE.

APPLICATION FILED AUG. 18, 1917.

1,284,851.

Patented Nov. 12, 1918.

2 SHEETS—SHEET 1.

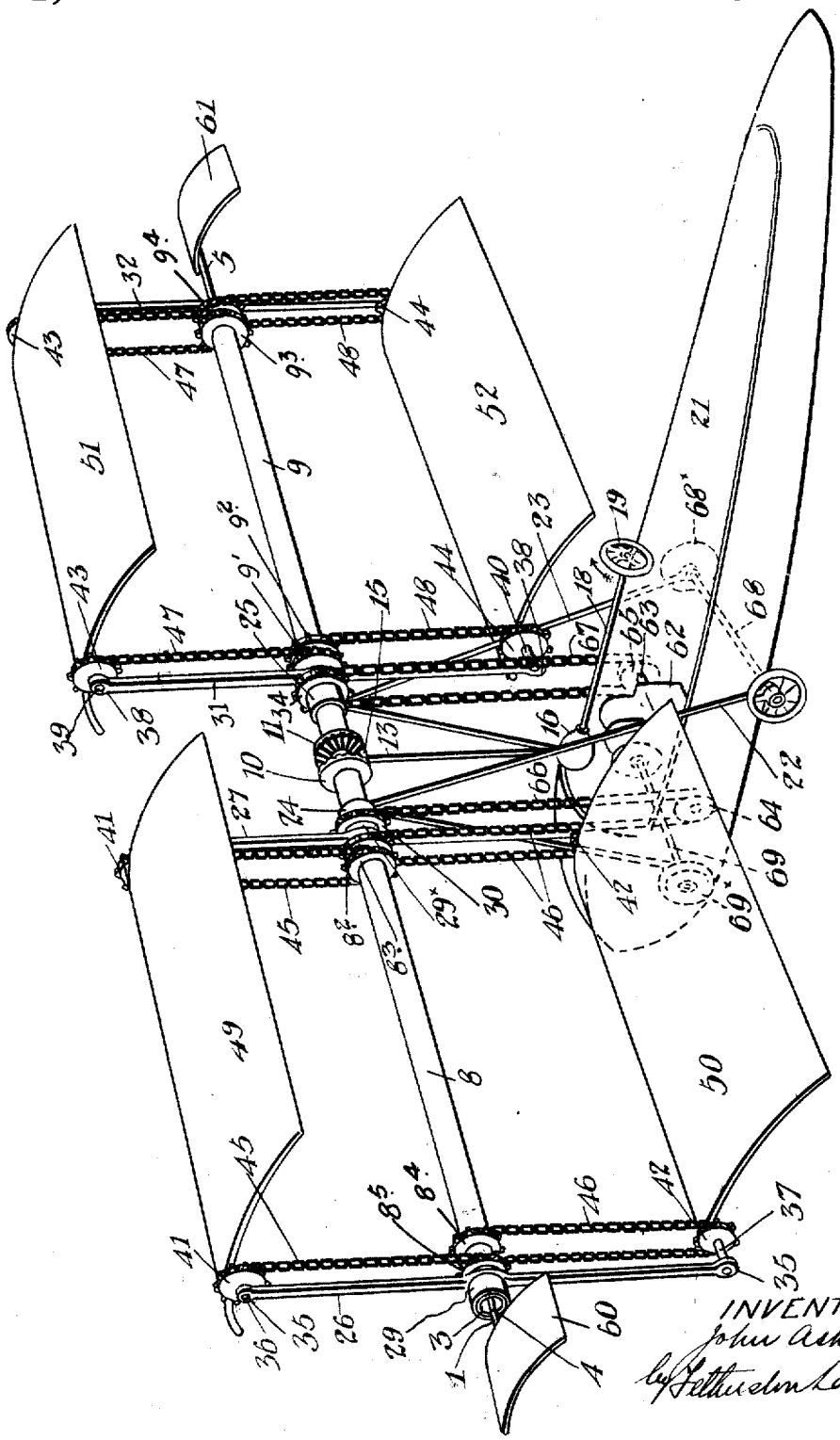


Fig. 1.

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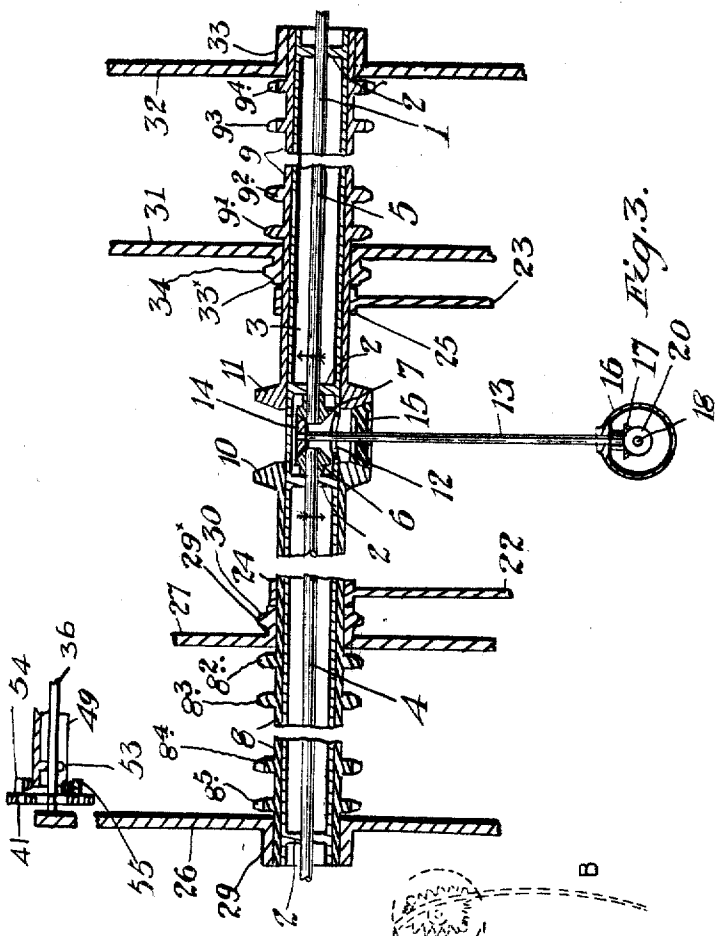


Fig. 3.

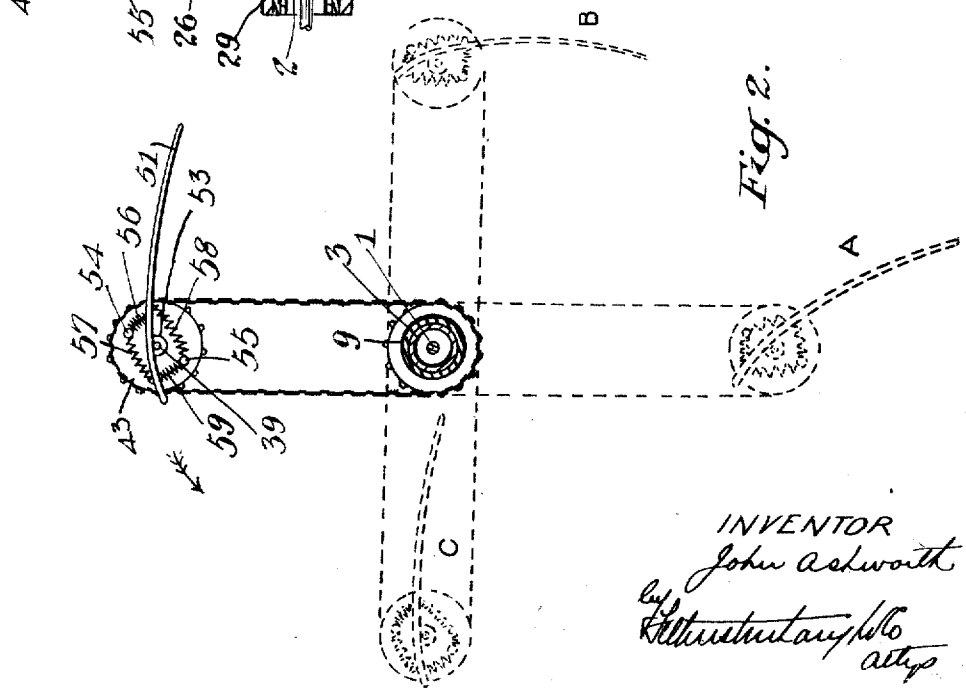


Fig. 2.

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UNITED STATES PATENT OFFICE.

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AEROPLANE.

1,284,851. Specification of Letters Patent. Patented Nov. 12, 1918.

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To all whom it may concern:

Be it known that I, JOHN ASHWORTH, of the city of Toronto, in the county of York, in the province of Ontario, Canada, have invented certain new and useful Improvements in Aeroplanes, of which the following is the specification.

My invention relates to improvements in aeroplanes and the object of the invention is to provide an aeroplane having a maximum active or movable flying surface, and a small passive or stationary surface, in which the angle of incidence of the planes forming the active flying surface may be altered so that the direction of the slip stream and the resultant pressure may be directed either forward, backward, downward or upward. Automatic lateral stability is caused by the equalization of pressures on the planes added to the gyroscopic effect of the rapidly rotating masses of the planes, in which automatic longitudinal stability is provided, in which the steering may be effected by adjustment of the planes without the employment of a rudder or warp and by which great weights can be carried at low speed and light weights at high speed and it consists essentially of the following arrangement and construction of parts as hereinafter more particularly explained.

Figure 1, is a general perspective view of my aeroplane.

Fig. 2, is a side diagrammatic elevation of one of the planes showing approximately the various positions the plane assumes during one revolution of its rotation.

Fig. 3 is an enlarged longitudinal section intermediately broken away of the main portion of the mechanism for adjusting the planes.

In the drawings like letters of reference indicate corresponding parts in the various figures.

1 indicates a central shaft, which is mounted in bearing portions 2 formed in the tubular shaft 3. The central shaft 1 is divided into two members 4 and 5 provided at their inner ends with bevel pinions 6 and 7 located in close proximity one to the other.

8 and 9 indicate tubular shafts mounted upon the tubular shaft 3. The inner ends of the shafts 8 and 9 are provided with bevel gears 10 and 11. 12 indicates an orifice formed in the lower peripheral portion of the tubular shaft 3 opposite the divided ends of the shaft members 4 and 5. 13 indicates a hanging shaft provided at its upper end with a bevel pinion 14 hanging in mesh with the bevel pinions 6 and 7.

15 indicates a bevel gear also secured to the suspended shaft 13 and meshing with the lower peripheral portions of the gears 10 and 11. 16 indicates a gear casing suspended from the shaft 13 and 17 indicates a bevel pinion secured to the lower end of the shaft 13 and located within the casing. 18 indicates a steering shaft provided with a steering wheel 19 at its outer end and a bevel pinion 20 at its inner end meshing with the bevel pinion 17.

It will thus be seen that when the steering handle 19 is turned in the direction of arrow (see Fig. 1) that the shaft member 4 will be turned in the direction of arrow and the tubular shaft 8 turned in the opposite direction to arrow and in the opposite direction to the shaft member 4. Simultaneously with this operation the shaft member 5 is turned in the opposite direction to the shaft member 4 and the tubular shaft 9 in the opposite direction to the tubular shaft 8. When the steering wheel 19 is turned in the opposite direction of arrow the direction of rotation of the shaft members 4 and 5 and tubular shafts 8 and 9 is reversed.

21 indicates the body of the aeroplane, which may be in boat form or any other form desired, such body being suspended by inverted V-shaped hanger members 22 and 23 provided with collar portions 24 and 25 at their apexes, such collar portions being swung upon the tubular shafts 8 and 9. By this means no matter in what direction the aeroplane is moving the body of the aeroplane is held in a horizontal position suspended from the operative portions of the plane.

The tubular shaft 8 is provided with sprocket gears 8^2 and 8^3 at one end and sprocket gears 8^4 and 8^5 at the opposite end. The tubular shaft 9 is provided with

sprocket gears 9′ and 9^2 at one end and sprocket gears 9^3 and 9^4 at the opposite end.

26 and 27 indicate arms extending diametrically from the tubular shaft 8 and provided intermediately of their length with sleeve like portions 29 and 29× which are freely mounted upon the shaft 8 in proximity to each end thereof. The sleeve portion 29× is provided with a gear 30 formed integral therewith or rigidly secured thereto.

31 and 32 indicate diametrically extending arms similar to the arms 26 and 27, such arms being provided with sleeve like central portions 33 and 33× freely mounted upon the tubular shaft 9, the portion 33× being provided with a sprocket gear 34 similar to the sprocket gear 30. Between the ends of the arms 26 and 27 and attached firmly to them are placed shafts 36 and 37 and between the ends of the arms 31 and 32 and attached firmly to them are placed similar shafts 39 and 40. In proximity to each end of the shaft 36 and revolving thereon is freely mounted a sprocket gear 41. In proximity to each end of the shaft 37 and revolving thereon is freely mounted a sprocket gear 42 and in proximity to each end of the shaft 39 and revolving thereon is freely mounted a sprocket gear 43 and in proximity to each end of the shaft 40 and revolving thereon is freely mounted a sprocket gear 44.

45 indicates a sprocket chain connecting each of the sprocket gears 41 respectively to the sprocket gears 8^5 and 8^6. 46 indicate sprocket chains connecting each of the gears 37 respectively to the sprocket gears 8^3 and 8^4. 47 indicates a sprocket chain connecting each of the sprocket gears 43 respectively to the sprocket gears 9^1 and 9^3 and 48 indicates a sprocket chain connecting each of the sprocket gears 44 respectively to the sprocket gears 9^2 and 9^4.

49, 50, 51 and 52 indicate cambered planes. Each of the planes is provided with lugs 53 preferably located in proximity to each end thereof and through which the respective shafts 36, 37, 39, and 40 freely extend thereby swingably supporting the plane in position. In order to resiliently hold the plane in its true position each of the gears 41, 42, 43 and 44 is provided with inwardly extending pins (see Fig. 2) 54 and 55. To the pin 54 is secured two spiral springs 56 and 57 and to the pin 55 is secured two spiral springs 58 and 59. The springs 58 and 59 are secured to the lower face of the plane, and the springs 56 and 57 to the upper face of the plane.

When the plane is in the normal or horizontal position such as shown by full lines in Fig. 2 the springs 57 and 58 are under tension and the springs 56 and 59 are under compression.

60 and 61 indicate supplemental planes rigidly secured to the ends of the divided members 4 and 5 of the central shaft 1. 62 indicates the driving engine, the shaft 63 of which is provided at its ends with sprocket gears 64 and 65 connected by sprocket chains 66 and 67 to the sprocket gears 30 and 33× mounted upon the sleeve like portions 30 and 34.

The aeroplane body is provided with axles 68 and 69 to which the lower ends of the inverted V-shaped hangers 22 and 23 are connected, the ends of the axles being provided with carrying wheels 68× and 69× of usual construction.

Having described the principal parts involved in my invention I will briefly describe the operation of the same.

When the engine shaft 63 is thrown into gear the sprockets 30 and 33× are driven from such engine shaft thereby rotating the arms 26 and 27, 31 and 32 mounted upon the tubular shafts 8 and 9 thereby carrying the planes 49, 50, 51 and 52 through a circular path. The travel of each of the planes 49, 50, 51 and 52 is approximately illustrated in Fig. 2.

It will thus be seen that as the plane travels forwardly in the direction of arrow and downwardly the springs 59 and 56 are held in compression until after the position C is passed when the spring 59 gradually passes from compression into tension, the spring 57 from tension into compression, the spring 56 from compression into tension and the spring 58 from tension into compression, this action being produced by the rearward swing of the plane during its circular travel producing a pressure upon the back of the plane so as to swing it toward a vertical position, which position is indicated by dotted lines at A (Fig. 2). As the plane passes upwardly from position A to position B the plane assumes practically a vertical position further compressing the springs 57 and 58 and further drawing the springs 56 and 59 into tension.

As the plane travels forward and upward from position B it reverts rapidly back to normal position shown by dotted lines in Fig. 2, the compression on the back of the plane being overcome by the pressure against the lower side. The pressure on the lower face of the plane is directed downwardly and forwardly upon the air to produce a sustaining and propelling force while the resistance to the backward and upward movement also produces a forward reaction.

The extent of movement of the planes relatively to the sprocket gears to which they are attached is ordinarily not large depending upon the strength of the springs, the speed of revolution and the flight speed of the aeroplane. If desired the springs may be weakened and the pins so placed that the planes while exerting a powerful pressure

upon their forward and downward movement will swing into such a position during part of their backward and upward movement as to experience little resistance except friction.

The revolution of the planes creates a resultant pressure in one direction depending upon the angle of incidence of the planes. By altering the angle of incidence the pressure may be exerted in an upward, forward, downward or backward or in any intermediate direction.

During flight the planes act as supporting as well as propelling members.

When it is desired to alter the angle of incidence of the planes so as to direct the path of travel in an upward or downward inclined direction all that it is necessary to do is to force the steering handle 19 either forward or backward longitudinally of the body of the aeroplane thereby rotating the gears 10 and 11 by the intermeshing gear 15 carried by the shaft 13 in the same direction and thereby through the gears 8^2, 8^3, 8^4, and 8^5 and $9'$, 9^2, 9^3 and 9^4 and sprocket chains 45, 46, 47 and 48 rotate the gears 41 and 42, 43 and 44 thus causing the planes 49, 50, 51 and 52 to rotate about their respective shafts 36, 37, 39 and 40 and varying their angles of incidence to any desired extent.

If it is desired to turn the plane in a curved path the shaft 13 is turned by means of the steering shaft 18 and steering wheel 19 so that the gears 10 and 11 are turned in opposite directions and thereby turning the gears 8^2, 8^3, 8^4 and 8^5 in one direction and the gears $9'$, 9^2, 9^3 and 9^4 in the opposite direction and thereby through the aforementioned sprocket gear increasing the angle of incidence of the planes 49 and 50 and decreasing the angle of incidence of the planes 50 and 51 or vice versa thereby increasing the forward propulsive force on one side of the machine and decreasing it upon the other thus causing the one side to fly faster than the other so that a turning movement is produced.

To facilitate this movement and to counteract the tendency of the retarded planes to rise I have provided supplemental planes or ailerons 61. The angle of incidence of these is changed simultaneously with the operation of changing the angle of incidence of the main planes but in an opposite direction to the direction of the main plane so that on that side of the machine on which the angle of incidence of the main planes is increased the angle of incidence of the corresponding aileron is decreased and on the opposite side of the machine, where the angle of incidence of the main planes is decreased, the angle of incidence of the corresponding aileron is increased.

It will also be seen that the longitudinal stability of the body of the aeroplane is automatically maintained by reason of the body being suspended movably from a tubular shaft and the center of gravity shifted backward or forward as the angle of incidence of the planes is changed, so that no matter in what direction the propelling force is carrying the machine the body always hangs in the same direction, being always held in a horizontal position and cannot be moved longitudinally out of such horizontal position by any alteration in the course of the plane.

It will also be seen from the above description that by altering the angle of incidence of the planes comprising the flying surface the direction of the slip stream is changed so that the resultant pressure may be directed either forward, backward, downward or upward. This gives the greatest possible speed variation from nothing to the highest speed attainable enabling the aeroplane to rise practically perpendicularly, to hover over a given point to go forward at the highest possible speed to reverse the direction of progress and to descend perpendicularly and, therefore, the danger of alighting on rough ground or at night is to a great extent obviated.

It will also be seen that owing to the bevel gear connection 15 between the supplemental tubular shafts 8 and 9 if the total pressure on the planes on one side of the central body at any time by reason of sudden gusts of wind or otherwise exceeds the total pressure on the planes on the other side of the central body then the pull on the sprocket chains acting through the bevel gear will cause the angle of incidence of the planes having greater pressure to be reduced and the angle of incidence of the other planes to be correspondingly increased until the pressures are equal on each side, thus providing automatic lateral stability. Added to this is the gyroscopic effect of the masses of the rapidly rotating planes about the central shaft.

It will also be noticed that in the event of stoppage of engine all the planes will at once assume a horizontal position automatically by reason of the air pressure on the under surface and the aeroplane as a whole will come to the ground much as a parachute. During the descent the angle of incidence of the planes can be changed as desired.

What I claim as my invention is:

1. An aeroplane comprising a central body and planes located at each side of such body, means for revolving the planes as a whole about a common transverse horizontal axis, means for retaining the said planes at any desired angle of incidence with the horizontal, and a single means whereby the

angle of incidence of the planes may be adjusted in the same direction or the angle of incidence on one side of the machine changed in one direction and the angle of incidence of the plane on the opposite side of the machine changed in the opposite direction.

2. An aeroplane comprising a central body and planes located at each side of such body, means for revolving the planes as a whole about a common transverse horizontal axis, means for retaining the said planes at any desired angle of incidence with the horizontal, means for adjusting the angle of incidence of the planes on one side of the machine in one direction and the angle of incidence of the planes on the opposite side of the machine in the opposite direction, and means for counteracting the lifting or depressing action of the planes due to reversing the direction of the angle of incidence of the planes on each side of the center of the machine.

3. In an aeroplane, a main support, an aeroplane body carried by the support intermediately of its length, independent planes located upon each side of the body on opposite sides of the supporting member, a steering shaft located in the center of the supporting member, and a shaft swingably mounted at its upper end and mechanism connecting the shaft to the planes whereby the backward and forward swing of the shaft alters the angle of incidence in the same direction on both sides of the machine.

4. In an aeroplane, a main support, an aeroplane body carried by the support intermediately of its length, independent planes located on each side of the body on opposite sides of the supporting member, a steering shaft swingably mounted at its upper end at the center of the supporting member, and means operated by the turning moveemnt of the shaft for increasing the angle of incidence of said planes on one side of the machine in one direction and decreasing the angle of incidence on the opposite side of the machine in the opposite direction, and means for rotating the planes around the main support.

5. In an aeroplane, a main support, an aeroplane body carried by the support intermediately of its length, independent planes located on each side of the body on opposite sides of the supporting member, a shaft swingably mounted at its upper end at the center of the supporting member, mechanism operated thereby for simultaneously adjusting the angle of incidence of the planes on both sides of the machine, an aileron also carried by the supporting member at each side of the center of the machine, and means operated by the swingably mounted shaft whereby each aileron is turned in the opposite direction to the plane on the corresponding side of the machine when the angle of incidence of such plane is altered upon rotation of the swingably mounted shaft on its own axis.

6. An aeroplane comprising a tubular shaft, an aeroplane body suspended from the shaft intermediately of its length, a pair of diametrically extending arms revolubly mounted upon the tubular shaft intermediately of their length, planes swingably carried upon the ends of the arms, resilient means for yieldably holding the planes in position, means for revolving the arms around the tubular shaft, a supplemental tubular shaft carried by the aforesaid tubular shaft on each side of the center of the machine, a sprocket gear connection between the supplemental tubular shaft and each of the planes, a steering shaft located above the body of the aeroplane, and means operated by the turning of the shaft for rotating the supplemental tubular shaft to adjust the angle of incidence of the planes.

7. An aeroplane comprising a tubular shaft, an aeroplane body suspended from the shaft intermediately of its length, a pair of diametrically extending arms revolubly mounted upon the tubular shaft intermediately of their length, planes swingably carried upon the ends of the arms, resilient means for yieldably holding the planes in position, means for revolving the arms around the tubular shaft, a supplemental tubular shaft carried by the aforesaid tubular shaft on each side of the center of the machine, a sprocket gear connection between the supplemental tubular shaft and each of the planes, a steering shaft located above the body of the aeroplane, and means operated by the movement of the steering shaft for turning the supplemental tubular shafts either in the same direction or in opposite directions.

8. An aeroplane comprising a tubular shaft, an aeroplane body suspended from the shaft intermediately of its length, a pair of diametrically extending arms revolubly mounted upon the tubular shaft intermediately of their length, planes swingably carried upon the ends of the arms, resilient means for yieldably holding the planes in position, means for revolving the arms around the tubular shaft, a supplemental tubular shaft carried by the aforesaid tubular shaft on each side of the center of the machine, a sprocket gear connection between the supplemental tubular shaft and each of the planes, a steering shaft located above the body of the aeroplane, means operated by the movement of the steering shaft for turning the supplemental tubular shafts either in the same direction or in opposite directions,

shaft members carried within the tubular shafts, ailerons carried at the outer ends of the shaft members, and means operated by the steering shaft whereby when the supplemental tubular shafts are turned in opposite directions to change the angle of incidence of the planes the corresponding ailerons are turned in the opposite directions to the corresponding shafts, and planes operated from such tubular shafts.

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Witnesses:
M. EGAN,
H. LUCE.