

Dec. 15, 1931.

R. E. WIKE

1,836,351

AEROPLANE

Filed June 10, 1929

3 Sheets-Sheet 1

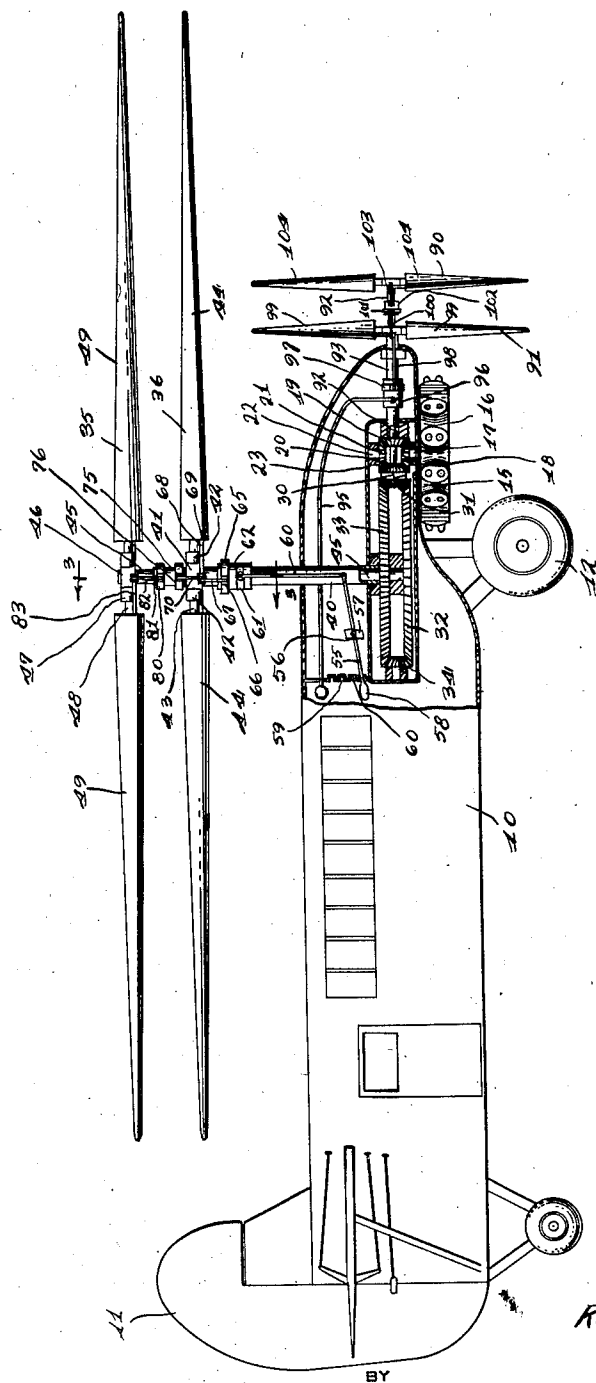


Fig. 1.

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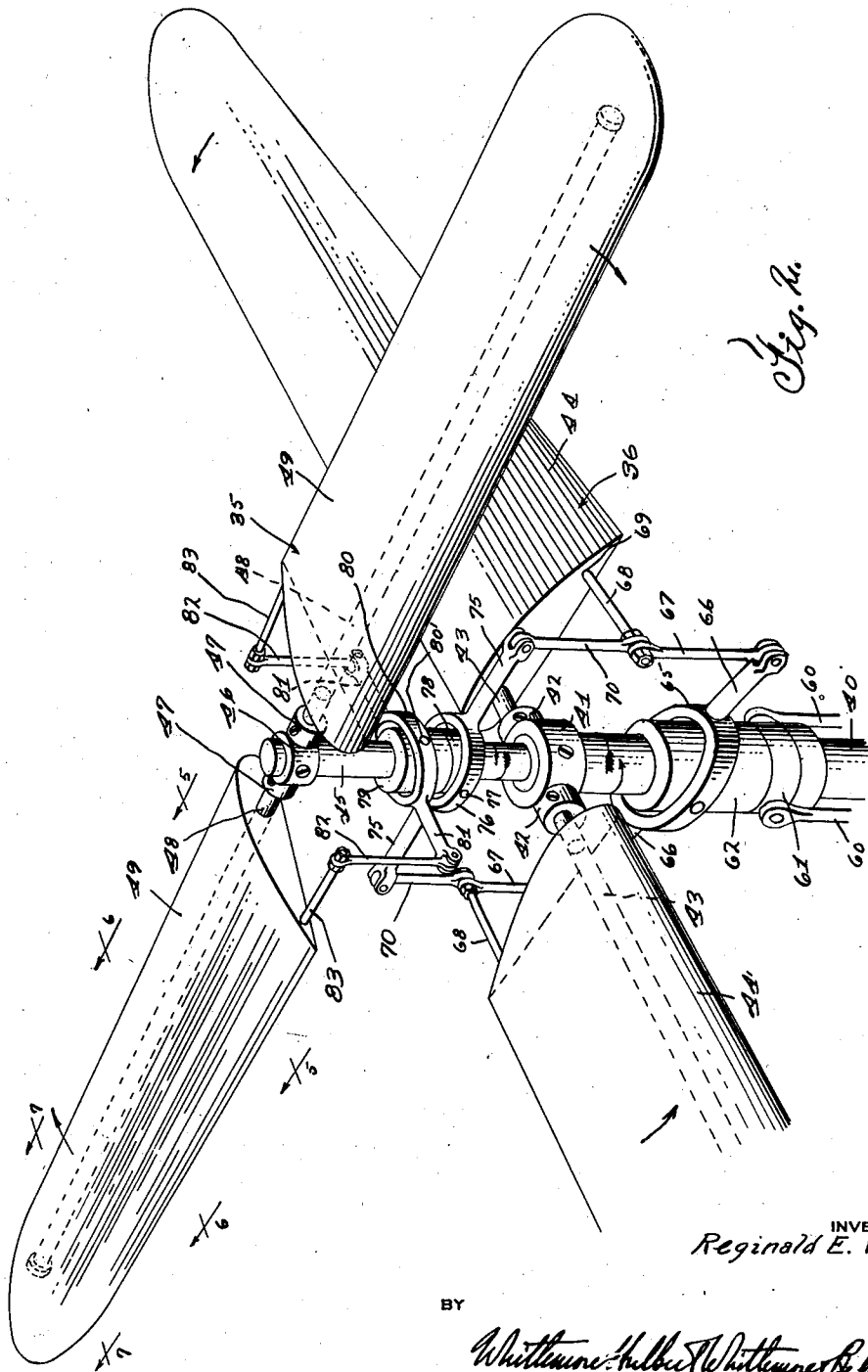
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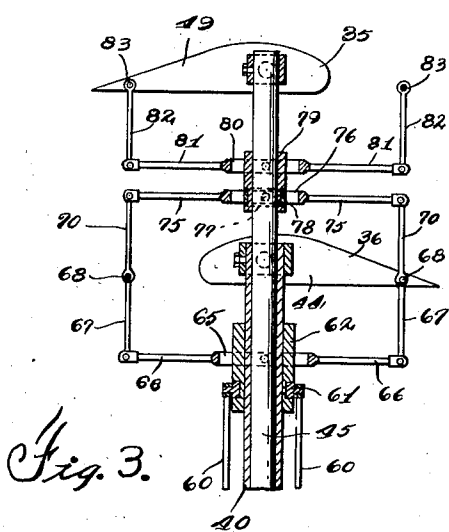


Fig. 3.

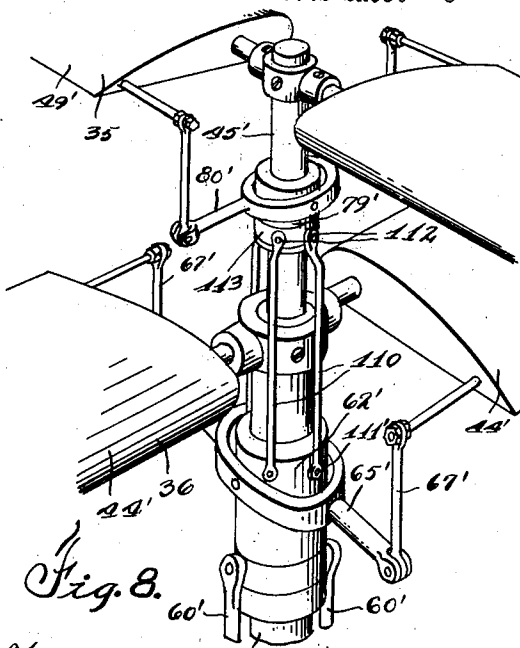


Fig. 8.

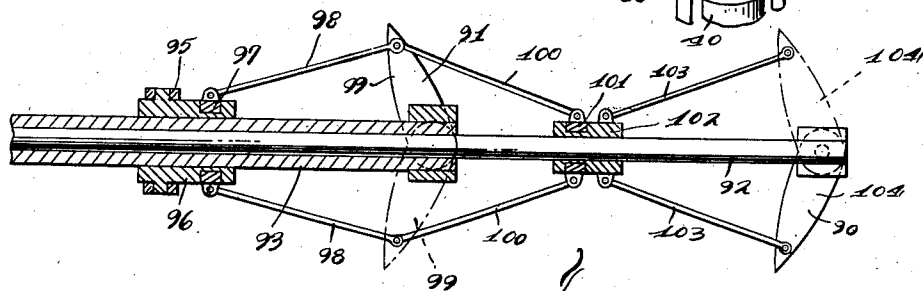


Fig. 4.

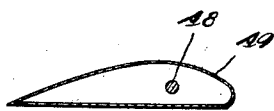


Fig. 5.



Fig. 7.

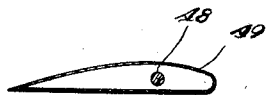


Fig. 6.

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AEROPLANE

Application filed June 10, 1929. Serial No. 369,798.

This invention relates to aeroplanes and has particular reference to an aeroplane provided with means for effecting both vertical and horizontal flights.

One of the primary objects of this invention is to provide an aeroplane with wings mounted for rotation in a horizontal plane to exert a lifting force on the aeroplane together with means for adjusting the angle of incidence of these wings.

A further object of this invention is to provide an aeroplane having wings of the above mentioned character together with means for automatically balancing the angles of incidence of said wings to thus eliminate the danger of said wings exerting an upsetting force on the aeroplane.

The invention further contemplates the provision of a plurality of propellers for effecting a forward drive of the aeroplane together with a novel means for mounting a motor for driving the said propellers and the first mentioned wings, whereby the wind resistance will be decreased to a minimum.

Other objects and advantages of the invention together with the numerous novel details of construction will become more apparent as the following description proceeds, particularly when reference is had to the accompanying drawings, wherein

Figure 1 is a semi-diagrammatic elevational view partly in section of an aeroplane showing the invention applied to the same;

Figure 2 is a detail perspective view of a portion of the aeroplane shown in Figure 1;

Figure 3 is a vertical sectional view taken substantially on the line 3—3 of Figure 1;

Figure 4 is an elevational view partly in section of a portion of the aeroplane shown in Figure 1, showing the actuating mechanism for the propellers;

Figures 5 to 7 inclusive are sectional views taken substantially on the lines 5—5, 6—6 and 7—7 of Figure 2; and

Figure 8 is a view similar to Figure 2, showing a slightly modified form of construction.

Referring now particularly to the drawings wherein like reference characters designate corresponding parts throughout all

views, there is semi-diagrammatically illustrated in Figure 1 an aeroplane including the fuselage 10, this fuselage being provided in accordance with the usual practice with the rudders 11 and landing gear 12.

Fixed to the fuselage 10 and adjacent the forward end of the same, as by the brackets 15, is a motor 16, this motor being preferably of the radial type and being horizontally mounted as clearly illustrated in Figure 1 of the drawings. The horizontal mounting of the motor permits the formation of the fuselage with a stream line forward end, thus decreasing to a considerable extent the wind resistance to the travel of the aeroplane. The horizontal mounting of the motor 16 possesses a further advantage since by virtue of this mounting, the motor is in the rear of and in alignment with the propellers adjacent the centers of the latter. Since the pitch of the propeller blades increases toward the centers of the propellers, more air will be forced rearwardly and into contact with the motor to cool the same by virtue of its arrangement adjacent the centers of the propellers. Thus, regardless of the pitch of the propeller blades air will always be forced rearwardly into contact with the motor during rotation of the propeller.

The motor 16 is provided with a shaft 17 and fixed to the end of this shaft is a bevel gear 18 adapted for driving engagement with the gears 19 and 20 respectively. If desired an idler gear 21 may be mounted for engagement with the gears 19 and 20 at a point opposite the gear 18 to aid in maintaining the gears 19 and 20 in position. The gear 21 is shown as mounted on a shaft 22 and while this shaft may, as illustrated, be a stub shaft having its ends journaled in a bearing 23, it is to be clearly understood that if desired this shaft may be extended for connection to a second radial motor horizontally arranged above the gears 19 and 20. The gear 18 may bear any desired relation to the gears 19 and 20 and in practice it has been found desirable to make the relation substantially 1 to 2, whereby the gears 19 and 20 are driven half as fast as the gear 18.

The bevel gear 20 is connected by a one-way

drive clutch, designated generally by the reference character 30, to a bevel gear 31 whereby the gear 31 may be driven from the gear 20 but may rotate faster than this gear. The gear 31 is arranged in meshing engagement with the gears 32 and 33, it being understood that by this arrangement these gears will be rotated in counter-directions. If desired a suitable idler gear 34 may be provided for meshing engagement with the opposite sides of the gears 32 and 33 to aid in maintaining these gears in their proper positions.

The gears 32 and 33 are adapted to drive the wings 35 and 36 respectively, these wings being mounted for rotation in horizontal planes above the fuselage 10 as clearly illustrated in Figure 1 of the drawings. For accomplishing this, the gear 33 is fixed to a sleeve 40 which projects vertically above the fuselage a predetermined desired distance. As shown in Figure 2 of the drawings, there is fixed to the upper end of the sleeve 40 a collar 41 provided with the diametrically opposed sockets 42. Each socket forms a mounting for a shaft 43 and mounted on each shaft 43 is a blade 44. The blades 44 may be pivotally mounted on the shafts 43 as illustrated or the blades may be fixed to the shafts, the shafts in this case being journaled in the sockets. The blades 44 are oppositely mounted whereby the lifts on these blades are on opposite sides of the shafts 43, as clearly illustrated in Figure 2 of the drawings. The two blades 44 form the wing 36 and this wing is adapted to be rotated as a unit by the sleeve 40 in the direction of the arrows in Figure 2 of the drawings.

For driving the wing 35 there is provided a shaft 45 fixed to the gear 32 and extending upwardly through the sleeve 40. This shaft is provided at its free end with the collar 46 formed with the diametrically opposed hubs 47 for receiving the shafts 48. Blades 49 are pivotally mounted on these shafts, these blades being mounted in a manner similar to the blades 44, whereby the lift on one blade is on one side of its shaft while the lift on the other blade is on the opposite side of its shaft. The blades 49 form the wing 35 and this wing will be rotated in a direction counter to the direction of rotation of the wing 36 as clearly illustrated by the arrows in Figure 2 of the drawings.

The blades 44 and 49 are preferably of the cross sectional shape shown in Figures 5 to 7 inclusive, it being noted that the blades taper gradually from their inner to their outer ends. Throughout its length however, each blade is so mounted on its respective shaft, that the center of lift on the blade will be eccentric to the axis of the shaft as will be clearly apparent by reference to the above mentioned figures. It will be further noted that in mounting the blades on their respective shafts, each shaft is offset from the upper

surface of its respective blade, whereby the moment arm length, that is, the distance from the supporting shaft to the center of pressure of the blade, will remain a fixed quantity throughout the adjustment of the blade hereinafter to be described.

It forms a feature of this invention to provide means for varying the angle of incidence of the wings 35 and 36 whereby the lifting effect of these wings may be varied at will. To accomplish this there is provided a lever 55 pivoted as at 56 to a supporting bracket 57 mounted at any desired point on the fuselage. The lever 55 is provided with a handle end 58 whereby the same may be actuated and if desired there may be provided a guide member 59 provided with the notches 60 in which the lever is adapted to be engaged for indicating the angle of adjustment of the lever 55 and for holding the lever in adjusted position.

The opposite end of the lever is bifurcated and is pivotally fixed to the vertically extending rods 60, these rods lying on opposite sides of the sleeve 40 as clearly illustrated in Figure 2 of the drawings. The rods 60 are pivotally connected at their upper ends to a ring 61 rotatably mounted on a sleeve 62. The sleeve 62 is mounted for sliding movement on the sleeve 40 and may rotate with this sleeve relative to the rods 60 by virtue of the rotatable mounting of the ring 61.

Pivotally mounted on the sleeve 62 and adjacent the upper end of the same is a yoke 65 provided with the diametrically extending arms 66. Pivoted to the outer end of the arms 66 are the links 67 which project vertically between the blades 44 of the wings 36. At its end each link 67 pivotally engages a pin 68 fixed as at 69 to one of the blades 44. It will be noted that the pins 68 engage the blades 44 on the unbalanced sides of the blades, whereby vertical movement of the sleeve 62 on the sleeve 40 will effect a vertical movement of the rods 67 and will thus vary the angles of incidence of the blades 44. Thus with the angle of incidence of the blades 44 at zero, in which position the wing 36 will have but a slight lifting effect, the sleeve 62 may be moved vertically and this vertical movement will be transmitted to the unbalanced sides of the blades 44 to elevate the entering edges of these blades to thus increase the angle of incidence of the blades and to increase the elevating effect of the wing 36. It will be obvious that the blades 44 will be simultaneously adjusted so that after manual adjustment by the lever 55 the blades 44 will each be fixed at the same angle of incidence.

In order that the blades 49 may be simultaneously adjusted with the blades 44, links 70 are provided, these links being pivotally connected at their lower ends to the pins 68 and at their upper ends to the diametrically opposed arms 75 of a yoke 76 pivoted as at

77 to a ring 78 rotatably mounted on a sleeve 79. The sleeve 79 is slidably mounted on the shaft 45 and pivoted to this sleeve is a yoke 80 having the diametrically opposed arms 81 to the outer ends of which are secured links 82 connected at their opposite ends to pins 83, each pin being fixed to the unbalanced side of one of the wings 49. Thus it will be seen that vertical movement of the sleeve 62 will be transmitted to the sleeve 79 and will in turn be transmitted to the links 82 through the yoke 80 and arms 81 to adjust the angle of incidence of the blades 49.

Thus the lever 55 may be adjusted to vary the angle of incidence of the wings 35 and 36 at the will of the operator and to thus adjust the elevating effect of these wings. It will be clearly apparent that by virtue of the arrangement of links connecting the lever 55 to the blades 44 and 49, these blades will be simultaneously adjusted upon adjustment of the lever. Further, if the blades of the wings are all initially set at the same angle of incidence, adjustment of the lever 55 will effect a substantially equal adjustment of all of the angles of incidence of all of the blades. In practice, however, it may be desirable to adjust the blades of wing 35 to one angle and the blades of wing 36 to a different angle and to accomplish this, separate adjusting mechanisms may be provided. To accomplish this result without providing separate adjusting mechanisms, the blades 49 of the wing 35 may be initially set at an angle differing from the blades 44 of the wing 36, in which event during the adjustment of the blades of the respective wings, the angles of incidence of the blades 49 will always bear a predetermined relation to the angles of incidence of the blades 44. Thus for example the blades 49 may, if desired, be set at zero degrees while the blades 44 may be set at minus two degrees, whereby upon adjustment of the blades by the lever 55, the blades 49 will always be at an angle of incidence two degrees greater than the angle of incidence of the blades 44.

The arrangement above described, in addition to providing means for adjusting the angle of incidence on the blades, functions further to effect an automatic balancing of the blades of each wing. Considering first the wing 35 which includes the blades 49 and assuming that during the rotation of this wing an upward force is exerted on the unbalanced side of one of the blades, this upward force will tend to move this blade about its pivot 48 and this movement will be transmitted through the pin 83 fixed to the blade and the link 82, to the yoke 80 which will rock about its pivot point 80' to thus draw the link connected to the other blade downwardly. Thus as the force acting upwardly on the one blade tends to decrease the angle of incidence of this blade, the links connecting this blade to the other blade of the same

wing will tend to increase the angle of incidence on the second mentioned blade, so that the sum total of the angles of incidence on both blades of each wing will always be the same. For example, if the angles of incidence are set to 15° and a force is exerted on the one blade of the wing tending to increase the angle of incidence of this blade to 20° , the links connecting this blade to the other blade will function to immediately decrease the angle of incidence of the other blade of the same wing to approximately 10° , so that the total of the two angles of incidence will be 30° or the same as originally adjusted.

This automatic balancing effect eliminates all danger of the aeroplane being upset by gusts of wind acting on the blades of the wings 35 and 36, it being clearly understood that the blades 44 will be balanced relative to each other in the manner described in connection with the blades 49. Thus with the blades adjusted to the desired angle of incidence, which adjustment may be made manually through the lever 55, the sum total of the angles of incidence of all of the blades will be the same by virtue of the automatic balancing effect of the connecting links. It will be understood that if one blade of one wing is upset slightly so that the angle of incidence of one blade is decreased and the angle of incidence of the other blade is increased, rotation of the blades will tend to equalize the angles of incidence so that during normal operation, the pivoted yokes will be substantially horizontal, the blades being at the same angle of incidence.

The invention further provides a pair of propellers for effecting a forward movement of the aeroplane. Thus as illustrated, in Figure 1 of the drawings, there is provided a propeller 90 and a second propeller 91. The propeller 90 is connected by a shaft 92 to the gear 20 while the propeller 91 is connected by a sleeve 93 to the gear 19. Thus the propellers will be rotated in opposite directions in the same manner as are the wings 35 and 36.

In order that the pitch of the propeller blades may be adjusted at the will of the operator, an arrangement similar to the arrangement of levers described in connection with the wings 35 and 36 is provided. In detail the adjusting mechanism includes a lever arm 95 mounted adjacent the lever arm 55 for movement longitudinally of the fuselage. The forward end of this lever is bifurcated and is connected to a sleeve 96 mounted for longitudinal movement on the sleeve 93.

Rotatable on the sleeve 96 is a ring 97 and pivoted to this ring are the links 98 pivotally connected at their ends to the blades 99 of the propeller 91. The links 98 are also pivotally connected to the links 100 which in turn are pivotally connected to a ring 101

rotatably mounted on a sleeve 102 slidably mounted on the shaft 92. Pivotally connected to the sleeve 102 are the links 103 which in turn are connected at their ends to the blades 104 of the propeller 90.

It will be seen that longitudinal movement of the lever 95 will effect a movement of the sleeve 96 longitudinally of the sleeve 93. This movement will be transmitted to the propeller blades 99 by the links 98 to vary the pitch of these blades and will further be transmitted to the sleeve 102 by the links 100. Longitudinal movement of the sleeve 102 on the shaft 92 will be transmitted to the blades 104 of the propeller 90 by the links 103 to thus adjust the pitch of the blades 104.

In Figure 8 a slightly modified form of construction is shown to take the place of the construction shown in Figure 2 of the drawings. In the modified construction the links 70 and the yoke 76 are eliminated, the sliding movement of the sleeve 62 being transmitted directly to the sleeve 79.

Thus as illustrated, the sleeve 62' may be slidably mounted on the sleeve 40 and may be adapted for actuation by the links 60' in the same manner as is the sleeve 62. Pivoted to the sleeve 62' is a yoke 65' connected by the links 67' to the blades 44'. Slidably mounted on the shaft 45' is a sleeve 79' and pivoted to this sleeve is a yoke 80' connected by the links 82' to the wings 49'. Instead however, of transmitting movement of the sleeve 62' to the sleeve 79' by virtue of links 70 and yoke 75, rods 110 may be provided, these rods being fixed to the sleeve 62' as at 111 and being fixed as at 112 to a ring 113 rotatably mounted on the sleeve 79'. Thus, vertical movement of the sleeve 62' will be transmitted directly to the sleeve 79' irrespective of the operation of the links which adjust the blades 44'.

From the above it is believed that the structure and operation of the invention will be clearly apparent. The wings 35 and 36 in addition to providing means for effecting a vertical flight of the plane, take the place of the wings normally mounted on an aeroplane. These wings are adapted to be driven in opposite directions by the motor 16 and are connected to the motor 16 by the one-way or overrunning clutch 30 whereby they may not only rotate faster than the motor but may also be moved relative to each other independently of the motor for alignment with the fuselage of the aeroplane. While the clutch 30 is shown as being mounted between the gear 20 and the gear 31, it will be clearly apparent that this clutch may, if desired, be eliminated at this point and similar clutches may be provided between the sleeve 40 and wing 36 and the shaft 45 and wing 35. Thus the wings 35 and 36 may be moved into alignment with the fuselage, permitting housing of the aeroplane in a hangar.

In flying the plane the motor may be started to drive the wings 35 and 36, it being understood that these wings rotate in opposite directions in the manner described. The angles of incidence of the blades 44 and 49 may be adjusted to cause the wings 35 and 36 to exert an upward pull on the aeroplane as will be clearly apparent. The propellers 90 and 91 will be rotated with the wings 35 and 36 and when the desired elevation is reached the propellers 90 and 91 may be adjusted to cause the same to exert a forward pull on the aeroplane. During flying of the plane the pitch of the propellers 90 and 91 together with the angles of incidence of the blades 44 and 49 may be varied at will to correspondingly regulate the upward and forward travel of the plane. When it is desired to descend the angles of incidence of the blades 44 and 49 may be properly adjusted to permit a gliding of the plane to its landing. Obviously if the motor should die during flight of the plane, the wings 35 and 36 may be adjusted as above mentioned to permit gliding of the plane to its landing.

With the plane in flight and the blades 44 and 49 properly adjusted to give the desired lift to the aeroplane, any force exerted on one of the blades of either of the wings tending to upset the plane will be immediately compensated for by the balancing means above described. Thus, if the angle of incidence of one blade of one wing is independently increased by an upsetting force, the angle of incidence of the other blade of the same wing will be correspondingly decreased so that the total angles of incidence of the two blades of each wing will remain the same.

The actuating mechanism for adjusting the blades of the wings 35 and 36 may extend on the outside of the sleeve 40 as illustrated or may be arranged centrally of the shaft 45 as will be clearly apparent. Further the reduction gearing between the motor 16 and the wings 35 and 36 and propellers 90 and 91 will permit the propellers and the wings to rotate more slowly than the motor, thus giving more power at a lower speed. Since there are two propellers and two wings, the propellers and wings need only rotate at one half the speed of the motor if such an arrangement is desired.

While the invention has been described with considerable detail it will be understood that the description is for the purposes of illustration only and is not definitive of the limits of the inventive idea. The right is therefore reserved to make such changes in the details of construction and arrangement of parts as will fall within the purview of the attached claims.

What I claim as my invention is:

1. In an aeroplane, a fuselage, a pair of horizontally aligned blades mounted for ro-

tation in a horizontal plane above said fuselage, and means for simultaneously adjusting the angles of incidence of said blades to the same degree, said means being operable upon movement of one of said blades out of the adjusted angle of incidence to simultaneously move the other blade to oppositely adjust the angle of incidence thereof.

2. In an aeroplane, a fuselage, a pair of horizontally aligned blades mounted for rotation in a horizontal plane above said fuselage, and means for adjusting the angles of incidence of said blades, said means being operable upon the independent increase of the angle of incidence of one of said blades to correspondingly decrease the angle of incidence of the other blade.

3. In an aeroplane, a fuselage, a shaft projecting vertically from said fuselage, a pair of horizontally arranged shafts having aligned axes fixed to said vertical shaft, a blade eccentrically mounted on each horizontal shaft for pivotal movement thereon, and means for equally adjusting the angles of incidence of said blades and operable upon an independent change in the angle of incidence of one of said blades to oppositely adjust the angle of incidence of the other blade.

4. In an aeroplane, a fuselage, a shaft projecting vertically from said fuselage, a pair of horizontally arranged shafts having aligned axes fixed to said vertical shaft, a blade eccentrically mounted on each horizontal shaft for pivotal movement thereon, and means for equally adjusting the angles of incidence of said blades and operable upon an independent change in the angle of incidence of one of said blades to oppositely adjust the angle of incidence of the other blade, said last mentioned means including a link connected to the unbalanced side of each blade, and a pivotally mounted yoke connecting said links.

5. In an aeroplane, a fuselage, a shaft projecting vertically from said fuselage, a pair of horizontally arranged shafts having aligned axes fixed to said vertical shaft, a blade eccentrically mounted on each horizontal shaft for pivotal movement thereon, and means for equally adjusting the angles of incidence of said blades and operable upon an independent change in the angle of incidence of one of said blades to oppositely adjust the angle of incidence of the other blade, said last mentioned means including a link connected to the unbalanced side of each blade, a yoke pivotally and slidably mounted on said vertical shaft connecting said links, and means for moving said yoke longitudinally of said vertical shaft.

6. In an aeroplane, a pair of wings mounted for rotation in opposite directions, each wing including a pair of blades, and a single means for adjusting the angles of incidence of all of said blades, said means be-

ing operable to adjust the blades of each wing to the same angle of incidence and to oppositely adjust the angle of incidence of each blade upon an independent change in the angle of incidence of the other blade of the same wing.

7. In an aeroplane, a pair of wings mounted for rotation in opposite directions, each wing including a pair of blades, a single means for adjusting the angles of incidence of all of said blades, said means being operable to adjust the blades of each wing to the same angle of incidence and to oppositely adjust the angle of incidence of each blade upon an independent change in the angle of incidence of the other blade of the same wing, a motor for rotating said wings, and a one-way clutch between said motor and said wings permitting rotation of said wings relative to said motor while permitting driving of said wings by said motor.

8. In an aeroplane, a fuselage, a pair of axially aligned blades mounted for rotation relative to said fuselage, and means for equally adjusting the angles of incidence of said blades, said means being operable upon an independent change in the angle of incidence of one of said blades to oppositely adjust the angle of incidence of the other blade.

9. In an aeroplane, a fuselage, a shaft carried by said fuselage, a pair of shafts having aligned axes fixed to said first mentioned shaft, a blade eccentrically mounted on each of said second mentioned shafts for pivotal movement thereof, and means for equally adjusting the angles of incidence of said blades and for balancing the angles of incidence thereof, said means including a link connected to the unbalanced side of each blade, a sleeve slidably mounted on said first mentioned shaft, a yoke pivotally mounted on said sleeve and connected to said links, and means for moving said sleeve longitudinally of said first mentioned shaft.

In testimony whereof I affix my signature.
REGINALD E. WIKE.

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