June 20, 1933. C. FAUVEL 1,915,055

AEROPLANE

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Fig. 1.

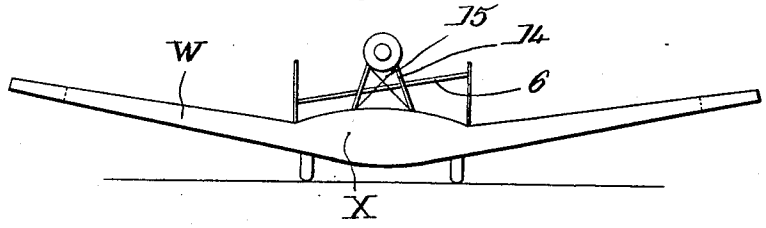


Fig. 2.

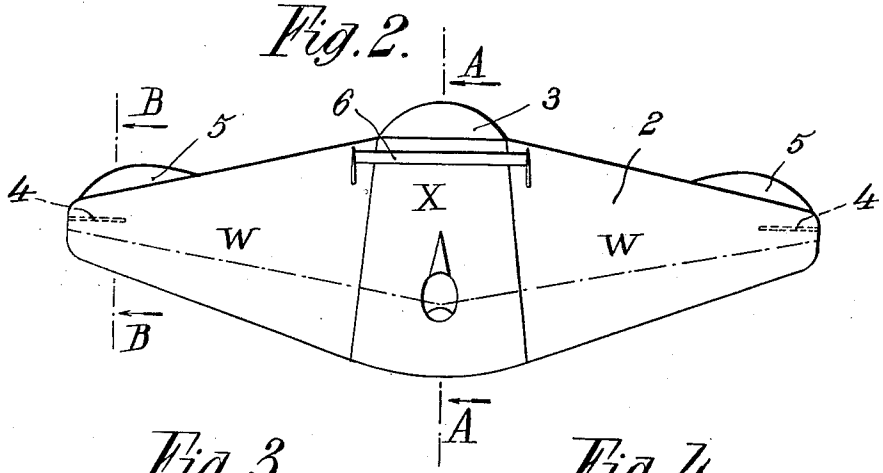


Fig. 3.

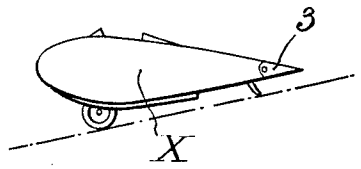


Fig. 4

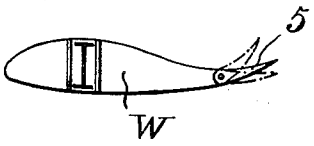
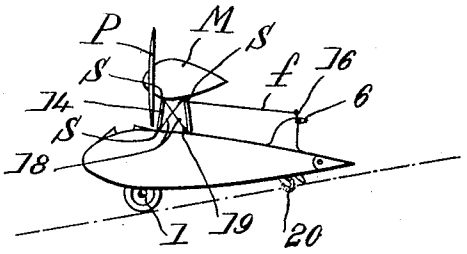


Fig. 5.



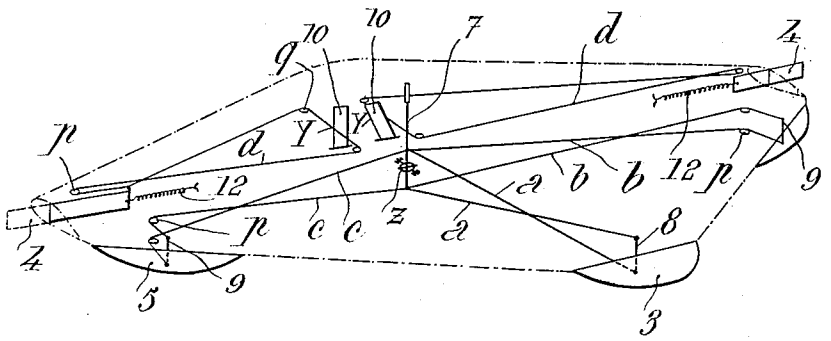
Charles Fauvel
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AEROPLANE

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Fig. 6.



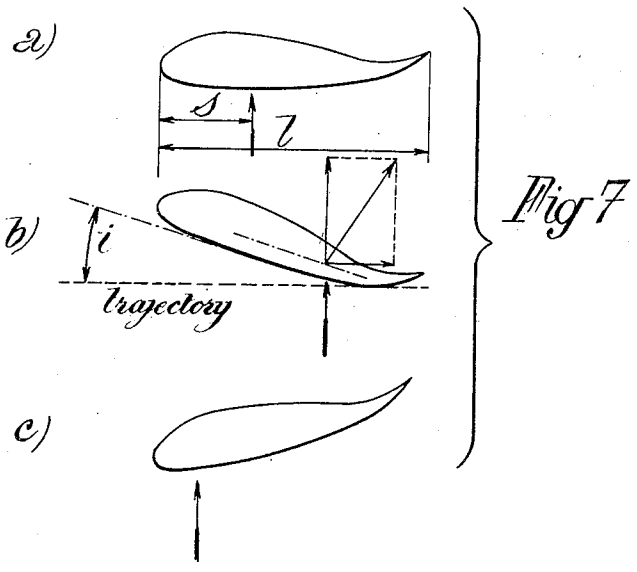


Fig 7

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UNITED STATES PATENT OFFICE

CHARLES FAUVEL, OF PARIS, FRANCE

AEROPLANE

Application filed February 24, 1930, Serial No. 430,623, and in France March 2, 1929.

The present invention relates to aeroplanes.

One of the objects of the invention is to provide a wing which in itself has the necessary aerodynamic properties for permitting flight without the adjunction of the usual tail structures now in use.

Another object is to provide means for changing the direction of an aeroplane without the use of a rudder.

Still another object is to provide means operative by the traction of a propellor to neutralize the forward turning couple exerted by the latter when set in motion.

An additional object is to provide means for neutralizing the lateral turning couple exerted by a propellor when set in motion.

A further object is to provide a special composite form of wing design permitting easy manœuvring of an altitude rudder attached directly to the wing.

Still further objects will appear in the course of the detailed description now to be given with reference to the accompanying drawings, in which:—

Fig. 1 is a front elevation of one illustrative embodiment of the invention;

Fig. 2 represents the same structure in plan;

Fig. 3 is a section taken on line A—A of Fig. 2;

Fig. 4 represents a section taken on line B—B of Fig. 2;

Fig. 5 is a lateral elevation of the aeroplane showing certain special stabilizing structures;

Fig. 6 represents the control system in transparent perspective;

Fig. 7 is a diagram representing the resultant of the aerodynamic forces acting on the wing for various angles of incidence.

General assembly

Referring to the various figures of the drawings, there is shown a landing gear 1 supporting a wing 2 whose profile and design will be described in detail further on, the wheels of the landing gear extending into the wing, an altitude rudder 3 hingedly connected to wing 2, direction control and braking elements 4, 4 slidably mounted to be extended beyond, and to be retracted into, the lateral extremities of wing 2, a pair of horizontal control elements 5, 5 of any desired design, hingedly mounted on wing 2, a stabilizer 6 pivotally mounted in an inclined position above rudder 3, a joy-stick control for altitude rudder 3 and horizontal control elements 5, 5 consisting of a joy-stick 7 universally mounted at Z, a vertical rod 8 rigidly attached to rudder 3, crossed cables a, a connecting opposite extremities of rod 8 to the joy-stick, a pair of rods 9, 9 rigidly connected to elements 5, 5, and crossed cables b, b, and c, c extending (1) from opposite sides of point Z on the joy-stick (2) over pulley p, (3) to opposite extremities of rods 9, 9, a control system for elements 4, 4 comprising oscillatable pedals 10, 10, pulleys q positioned in front and behind pedals 10, pulleys r positioned beyond the inner extremities of elements 4 when the latter are in retracted position, springs 12, 12 tending to draw elements 4 inward, and crossed cables d, d attached to pedals 10 at points Y extending over pulleys p and r to the inward extremities of elements 4, 4, a motor M provided with a propellor P, a support for the motor including pairs of struts 14 pivotally mounted at points s so that the motor may oscillate back and forth under the effect of variations in the traction exerted by the propellor, and stays 15 preventing lateral oscillation, and means for transmitting variations in the tractive effort of the propellor to stabalizer 6 consisting of an arm 16 rigidly attached to element 6, a cable f extending from one end of arm 16 to rear strut 14, and crossed stays composed of cables 18 and springs 19 extending diagonally to opposite extremities of struts 14.

Wing design

Up to the present time, it has been generally recognized that a tailless aeroplane composed simply of a wing carrying control structures should be designed so as to be what is called "auto-stable" in the art. But the term "auto-stable" has come to have a loose meaning irrespective of whether auto-stability was obtained by modifying (1) the hori-

zontal angle between the wings (i. e. the angle between each wing and the longitudinal center line), (2) the vertical angle between the wings (i. e. the angle between each wing and the transversal center line), (3) the amount of twist given the wing from center to tip, or (4) the profile of the wing itself. The wing forming the subject matter of the present invention falls into the fourth class of those enumerated above and is "auto-stable" solely because of its profile. So far as the inventor is aware, tailless aeroplanes, of this type, have never been constructed. While a wing having an "auto-stable" profile could be made to fly satisfactorily when the wings lie in the same straight line, the angle between each wing and the longitudinal center line being 90°, and without giving the wings any twist from center to tip, it has been found that for the sake of convenience of design (proper positioning of the center of gravity when the pilot is mounted in the forward-central part of the wing etc.) and ease of manœuvring, the wings of "auto-stable" profile may be tilted backward or upward or twisted from center to tip or both tilted and twisted. When these factors tending towards auto-stability are thus combined, the aeroplane, already auto-stable because of the wing profile becomes, to coin a new term, "superauto-stable".

As will be seen from the drawings, the wing is formed of a small central portion X (Fig. 3) of symmetrical biconvex profile and adapted to house the pilot and his controls, and a pair of relatively large lateral portions W, W having the auto-stable profile shown in Fig. 4. Portion X is given a biconvex profile to facilitate manœuvring of rudder 4, wings having the profile of portions W offering too great a resistance to displacement of an altitude rudder attached thereto. Portions W, in aerodynamic terms, are designed to have a CMo which is negative i. e. the coefficient of moment defined by the product of the coefficient of vertical sustaining component, by the ratio of the distances s and l is negative when Rz, the vertical sustaining component of the forces acting on the wing, equals zero (see Fig. 7) or has vanishing values.

When wing portions W are formed in accordance with the relations above specified, the point of application of the resultant of the aerodynamic forces acting on the wing in the manner shown in Fig. 7 (a), will move backward Fig. 7 (b) when the angle of incidence i increases, and forward Fig. 7 (c) when it decreases. In other words, the plane will tend to right itself when tilted either forward or backward without the intervention of the pilot.

Operation

The aeroplane operates, with few differences, in the same way as those now in use. In taking off, a small rear wheel 20, arranged to be lifted into the shell of wing portion X by proper controls (not shown) may be made use of, altitude rudder 3 being manipulated by joy-stick 7 in the usual way. As soon as the propeller starts turning, the tractive effort exerted thereby tilts struts 14 forward on pivots s, causing cable f to pull on arm 16 so as to tilt stabilizer 6 upward and produce a couple neutralizing the forward turning couple normally exerted during rotation of the propeller. Since, in addition, stabilizer 5 is normally supported in a laterally tilted position, the lateral turning couple produced by rotation of the propeller is also neutralized. When it is desired to change direction to right or left, one or the other of pedals 10 is depressed so as to act on a cable d to extend element 4 on the side that the turn is to be made, the added resistance of the extended element turning the machine in the direction desired. If it be desired to bank during the turn, or if the horizontality of the machine is disturbed during flight in a straight line, joy-stick 7 is manipulated in the usual way to manipulate elements 5, 5. In this connection, it is to be noted that these latter elements are, or should be, mounted so that one rises while the other descends. Moreover, the element which rises should move upward through a greater distance than the one which descends. Any current design of lateral control (elements 5) may be used to replace the one described. When it is desired to alight, rudder 3 is properly manipulated and, when the motor is cut off, both pedals, 10 are depressed to extend elements 4 on both sides. This increases immediately the value of the horizontal force components Rx (Fig. 7, b) i. e. has an effect on the latter similar to an increase in angle i, and decreases the ratio $\frac{Rz}{Rx}$ thus bringing the plane rapidly to rest without diminishing vertical force component Rz except in so far as the velocity of the plane is diminished, angle i remaining unchanged.

Aeroplanes constructed as hereinabove described have the advantages of (1) being "auto-stable" i. e. are self righting without manipulation of altitude rudder 3, (2) permitting homothetic construction on any scale, (3) navigating without a tail or similar appendages.

Wing portion X may serve as fuselage for seating the pilot and all the controls may be mounted therein. Obviously the invention is not to be taken as limited to the particular structures described thus: skis or floats may replace landing gear 1; wing portions W may be given other profiles than the one shown provided the "coefficient of moment for c_z equal to zero of the machine remains negative; element 4 may be replaced by structures of equivalent function tiltably mounted on

the top of the wing or elsewhere and lying flat during straight line flight; etc., etc.

What I claim is:—

1. An aeroplane having a central portion of airfoil profile and lateral wings, each of said lateral wings having substantially similar parallel profile sections from said central portion to their respective tips and said wings being of the type in which the resultant of the aerodynamic forces acting on said profile moves backward when the angle of incidence increases and forward when the angle of incidence decreases, and an elevation rudder articulating directly with said central portion, and forming a portion of the trailing edge thereof.

2. An aeroplane having a central portion of airfoil profile, and lateral wings, each of said lateral wings having substantially similar parallel profile sections from said central portion to their respective tips and said wings being of the type in which the resultant of the aerodynamic forces acting on said profile moves backward when the angle of incidence increases and forward when the angle of incidence decreases, and an elevation rudder forming a portion of the training edge of said central portion.

In testimony whereof I affix my signature.

CHARLES FAUVEL.