

N° 24,077



A. D. 1908

(Under International Convention.)

Date claimed for Patent under Patents and  
Designs Act, 1907, being date of first } 18th Nov., 1907  
Foreign Application (in France),

Date of Application (in the United Kingdom), 10th Nov., 1908

At the expiration of twelve months from the date of the first Foreign Appli-  
cation, the provision of Section 91 (3) (a) of the Patents and Designs Act,  
1907, as to inspection of Specification, became operative

Accepted, 18th Feb., 1909

### COMPLETE SPECIFICATION.

#### Improvements in or connected with Flying Machines.

We, WILBUR WRIGHT and ORVILLE WRIGHT, both of 1127 West Third Street,  
Dayton, County of Montgomery, State of Ohio, United States of America,  
Manufacturers, do hereby declare the nature of this invention and in what  
manner the same is to be performed; to be particularly described and ascertained  
5 in and by the following statement:—

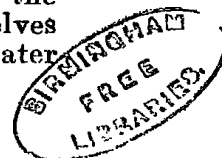
The present invention relates to flying machines of the aeroplane type, and  
the object of the invention is improvements in their lateral balancing; the  
aim of the invention is the realisation of this balancing by the arrangement  
on the right and left hand sides of these machines, of movable wings capable  
10 of being presented to the air at different angles of incidence, combined with  
surfaces the resistance of which to the movement of advance can be regulated  
synchronously with that of the horizontal wings.

The apparatus comprises horizontal planes or aeroplanes the lateral wings  
of which are movable, regulatable resistances arranged upon the right and  
15 left hand sides of the machine and capable of modifying the resistance to  
advance of the right and left hand wings.

The lateral balance is regulated by an augmentation of the angle of  
incidence at which the horizontal surfaces are presented to the atmosphere in  
the direction of the movement of advance, on the side which tends to descend  
20 and by a diminution of this angle on the side which tends to rise; this modi-  
fication of the inclination of the movement of the wings produces not only a  
variation in the horizontal balance but also on each wing a variation of the  
resistance to the movement of advance; the consequence of this latter variation  
is a slackening of the speed of the wing, the resistance of which has augmented,  
25 that is to say of the wing presented at the greater angle and an acceleration  
of the speed of the wing presented at the smaller angle and of which the  
resistance has diminished; this latter wing, in consequence of the greater speed  
with which it cleaves the air, tends to rise neutralising the effect sought.

For the purpose of opposing these movements there are arranged on the  
30 right and left of the centre regulatable resistances which oppose themselves  
to the movement of advance on the side of the wing which moves at the greater

[Price 8d.]



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speed so as to give, to the resistance to movement of this side of the machine the same value as to that of the other side and to thus keep the two wings at an equal speed.

The accompanying drawings given by way of example embody the invention.

Fig. 1 is a perspective view of a flying machine embodying the invention. 5

Fig. 2 is a horizontal section taken below the upper aeroplane.

In these drawings there has been represented a flying machine comprising aeroplanes placed one over the other and connected to each other and of which the lateral portions or wings are adapted to move about horizontal axes so as to give to the aeroplanes a helicoidal torsion determining upon each wing the different angles of incidence. The aeroplanes are indicated at 1 and 2; they are connected to each other by means of rigid rods or bars 3 fixed at their opposite ends by means of flexible or universal joints; each aeroplane is formed by a rectangular frame of which the greater length is perpendicular to the line of flight of the machine; this frame is of materials which unite the necessary resistance with the desired degree of flexibility, being for example of wood of good quality or of light metal rods. The two frames of the aeroplanes are covered with cloth; the rear transverse side  $b^1$  of each frame is formed of a central part and of two side portions jointed at  $b$ . The deformations of the aeroplanes are obtained by means of a cable 4 fixed at its ends to the rear movable corners of the wings of the upper aeroplane and passed under guides 5 carried by the frame of the lower aeroplane by means of small brackets 6. Between these guides the cable can be moved either towards the right or towards the left by an auxiliary cable 8<sup>a</sup>, carried back by a guide 4<sup>a</sup> onto a drum 7 mounted upon a shaft 8; this shaft is solidly fixed in supports 9 carried by the lower aeroplane. This drum is provided with a handle 10 and a brake 11 which prevents it from rotating about the shaft; a clamping screw 12 permits the friction on the shaft to be regulated. A second cable 13 is fixed at its ends to the lower wings and carried back onto the guides 14 of the upper aeroplane. By means of these cables, a single movement of the handle 10 communicates a helicoidal torsion to the right and left hand ends of the two aeroplanes, presenting them to the atmosphere at different angles of incidence, which permits, by the regulation of the angles of incidence, of keeping and reestablishing the lateral balance of the machine, the side presenting the greater angle of incidence to the atmosphere tending to rise, while the other side tends to descend. 15 20 25 30 35

This regulation of the balance would be perfect if a secondary phenomenon did not arise to interfere with the new working of the apparatus; the side of the aeroplane of which the angle of incidence has been augmented presents a more resisting surface to the movement of advance and its speed diminishes; the opposite wing of the aeroplane, presented at the smaller angle of incidence, offering a lesser resistance to this movement, moves more rapidly. For the purpose of opposing the secondary movements which tend to become produced, there are arranged at the right and left hands of the centre of the machine resistances to the movement of advance wings which can be regulated individually, for the purpose of creating on the side of the apparatus presented at the smaller angle of incidence, a supplementary resistance equal to the difference existing between the resistances to the advance of the right hand wings and of the left hand wings and to thus compel the two sides of the aeroplane to move at the same speed. 40 45 50

These regulatable resistances are preferably constituted by vertical vanes 15 each mounted upon a shaft or a vertical rod 16, the extremities of such shaft being located in the upper and lower frames of the aeroplanes near their front edges. Beneath each vertical vane 15 the shaft carries a pulley 17 upon which is fixed the end of a cable 18, the other end of which is attached to the corresponding pulley 17 of the vane 15 belonging to the other side of the machine. The cable 18 is provided with devices for working it and which 55

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allow of the vanes 15 being acted on. This action on the cable 18 is obtained by means of return pulleys 19<sup>a</sup> and a drum 19 mounted upon the shaft 8 provided with a handle 20 and a brake 21, the drum and the shaft being similar to the drum 7 and the brake 11. The handle 20 is preferably arranged parallel and quite near to the handle 10 so that the handles 10 and 20 may be grasped together by one hand and so that they can be made to act simultaneously on the drums 7 and 19. When the handle 20 is moved in one direction or the other, a pull is exerted upon one of the sides of the cord 18, the other side of this cord becomes slack. One of the vanes 15 is thus moved in the desired direction, presents itself obliquely to the line of flight and permits the other vane 15 to return to its normal position which is parallel to the trajectory of the machine. The brake 21 serves to maintain the vane in its new position until the drum 19 has been actuated again to bring it into another or cause it to resume its normal direction.

Finally the present invention is in no way limited to the regulation and reestablishment of the lateral balance of the flying machine described; an aeroplane formed of one or 3, 4 . . . . n planes may be balanced in this way; furthermore the invention does not aim at the lateral balancing of aeroplanes by the combination of helicoidal movements of their supporting planes with suitable position given to their lateral rudders; in a general way, its object is the balancing of these machines by the combination of horizontal surfaces movable at variable angles of incidence arranged upon the right and left hand sides of the machine with regulatable resistances situated upon the same sides, intended specially to modify more or less the resistance to the advance of these sides of the machine without influencing their support. It is applicable to aeroplanes in which the angles of incidence of all or part of the surface of the wings may receive different values upon the right and left hand sides of the machine, either by an action on one of these sides only, or by inverse actions upon the two sides. These modifications of the angles of incidence may be produced, in addition to the helicoidal movement described either by the raising of the wings on one side with immobilisation of the wings on the opposite side, or by the raising of the wings on one side and the simultaneous lowering of the wings on the other side, these movements being made about horizontal axes normal or transverse to the line of flight; these modifications of the angle may be applied only to movable fractions of the surface of the wings, which movable fractions are arranged preferably at their ends.

The lateral rudders may likewise be replaced by surfaces movable about axes normal to the line of flight, kept normally flattened down upon the planes of support and raised on the side of the machine which is presented at the smaller angle of incidence when a modification is made in the angles of incidence of the wings; for the same purpose there might likewise be employed longitudinal vertical surfaces arranged for example along the small sides of the aeroplanes, drawn at pleasure and brought forward by a return square on the extreme vertical rods connecting the horizontal superposed planes.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In a flying machine, the combination with a single or multiple aeroplane having lateral portions capable of being adjusted while in flight to different angles of incidence on the right and left sides of the machine, of regulatable resistances arranged upon the right and left hand sides of the machine for the purpose of increasing the resistance to advance of the side which tends to accelerate in speed, thus maintaining the speed of travel of both wings normally uniform.

2. In a flying machine, the combination with a single or multiple aeroplane having lateral portions capable of being adjusted while in flight to different

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angles of incidence on the right and left sides of the machine, of vanes adjustably mounted on opposite sides of the centre of the machine for the purpose of increasing the resistance to advance of that side of the machine which tends to accelerate in speed.

3. In a flying machine, the combination with a single or multiple aeroplane having lateral portions capable of being adjusted while in flight to different angles of incidence on the right and left sides of the machine, of vanes mounted on opposite sides of the centre of the machine operated by a cable which adjusts one vane while allowing the other vane to swing free. 5

4. In a flying machine, the combination with a single or multiple aeroplane having lateral portions capable of being adjusted while in flight to different angles of incidence on the right and left sides of the machine and regulatable resistances arranged upon the right and left sides of the machine, of means for operating the lateral portions and the resistances either separately or simultaneously, substantially as set forth. 10 15

5. In a flying machine, the combination with superposed connected aeroplanes comprising horizontal surfaces adjustable while in flight to different angles of incidence on opposite sides of the centre of the machine, of vertical vanes extending between said aeroplanes on opposite sides of the centre of said machine and pivotally connected thereto, and means for rotating the shafts on which vertical vanes are mounted, substantially as set forth. 20

6. In a flying machine, the combination with superposed connected aeroplanes comprising horizontal surfaces adjustable while in flight to different angles of incidence on the opposite sides of the centre of the machine and adjustable resistances mounted between said aeroplanes on opposite sides of the centre of the machine, cables for adjusting the planes of the resistances and drums for operating the cables, substantially as described with reference to the accompanying drawings. 25

Dated this 10th day of November 1908.

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Patent Agents for the Applicant. 30

FIG-1-

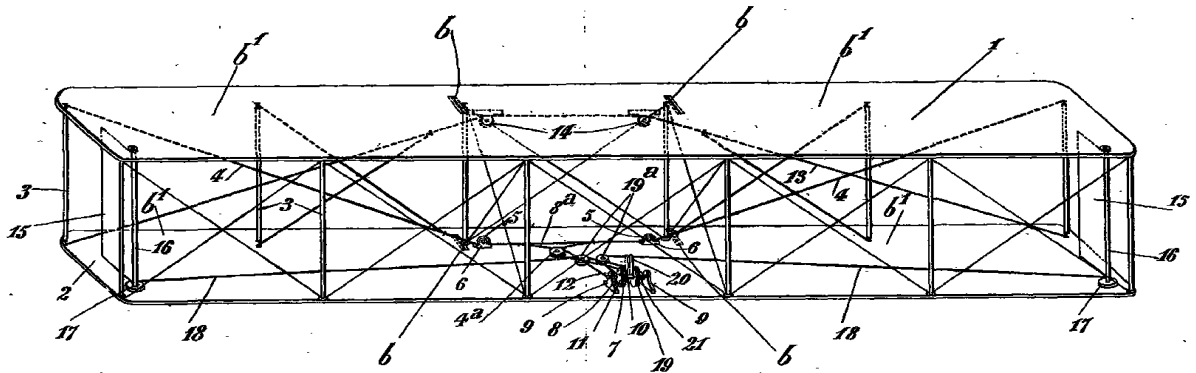
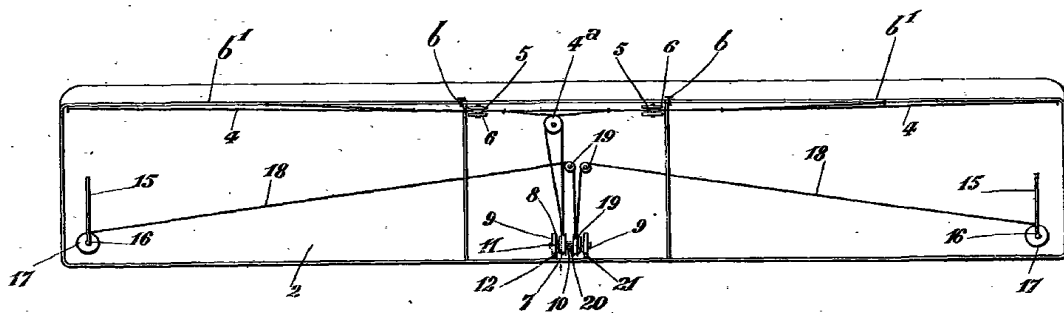


FIG-2-



[This Drawing is a reproduction of the Original on a reduced scale]

FIG. 1.

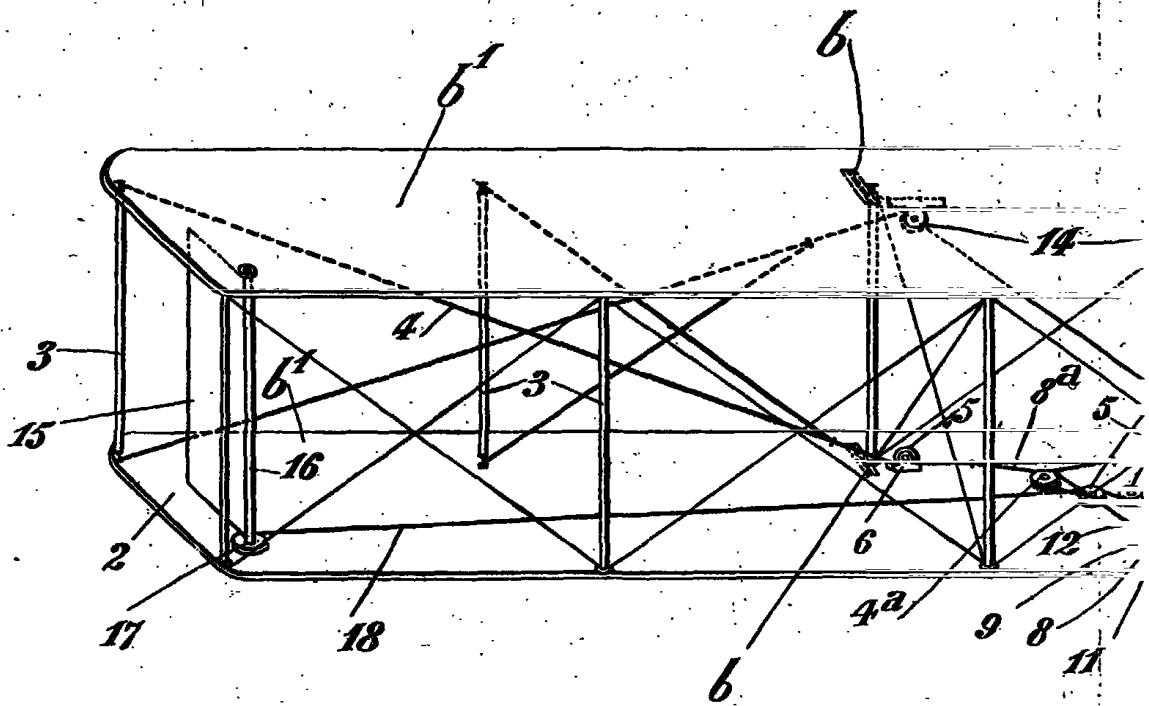
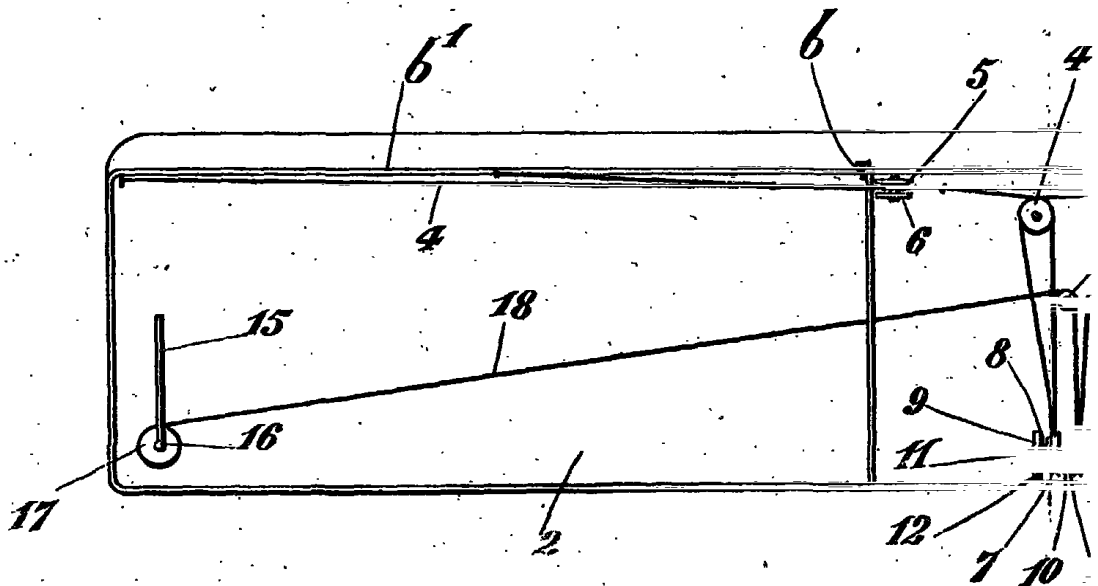
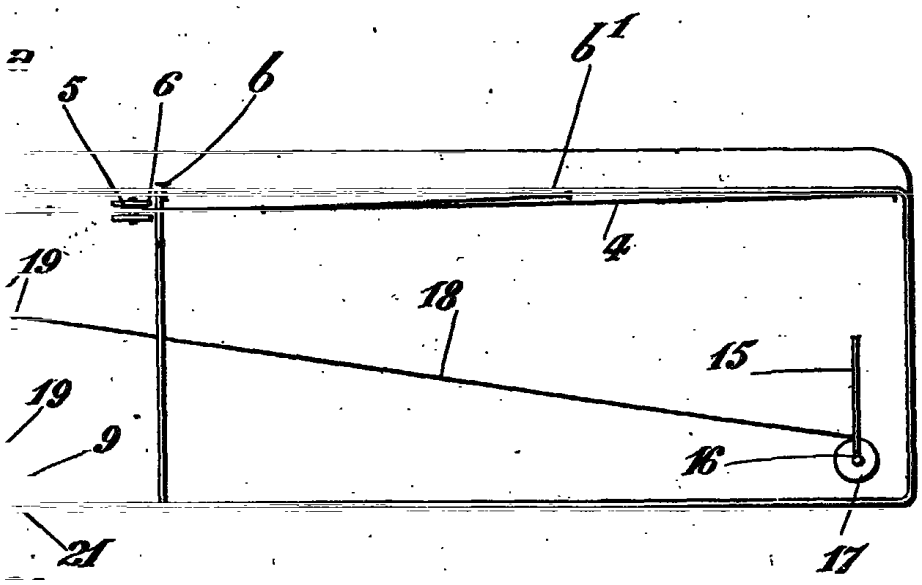
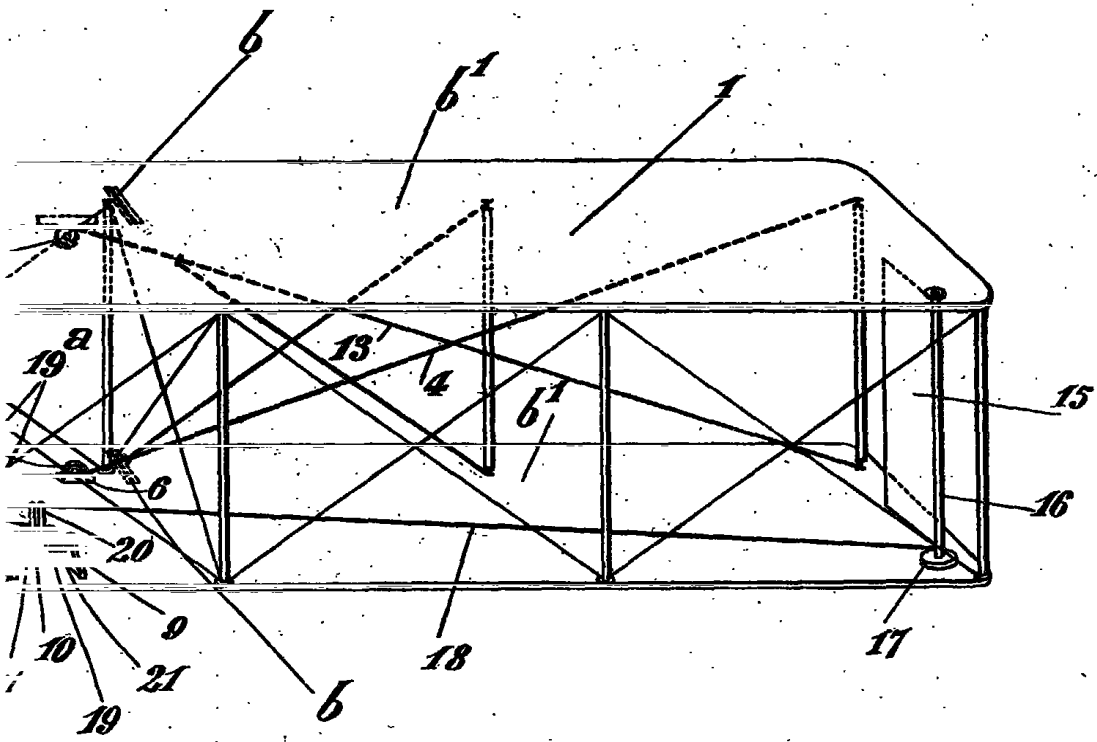


FIG. 2.



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