L. B. SPERRY.

TWIN PROPELLER AEROPLANE.

APPLICATION FILED OCT. 19, 1917.

1,353,544. Patented Sept. 21, 1920.

Fig. 1.

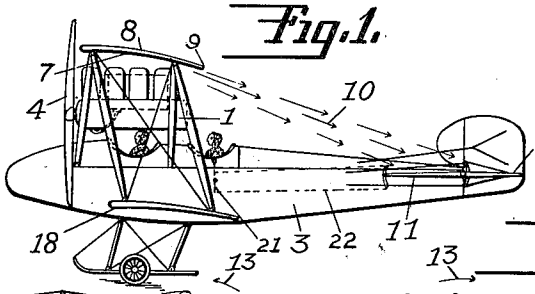



Fig. 6.

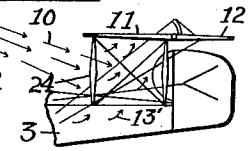



Fig. 2.

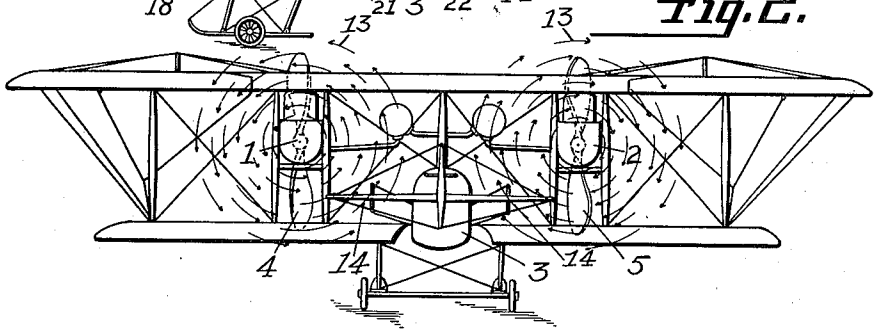



Fig. 3.

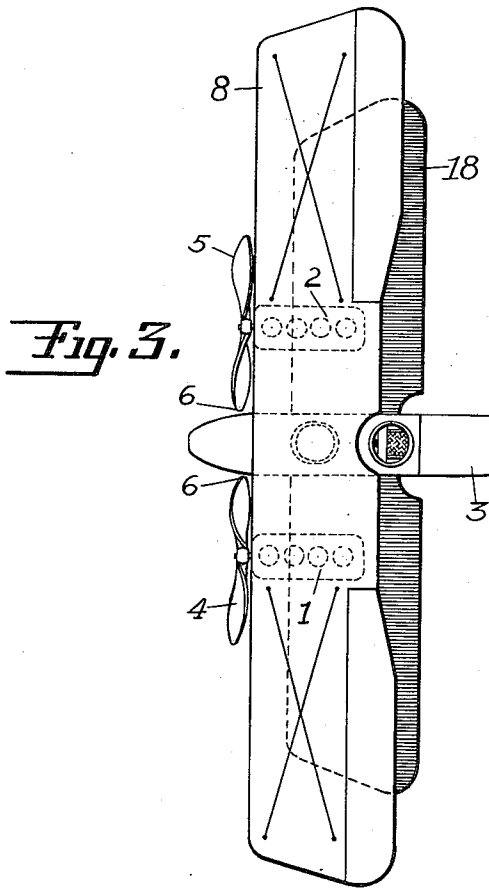



Fig. 4.

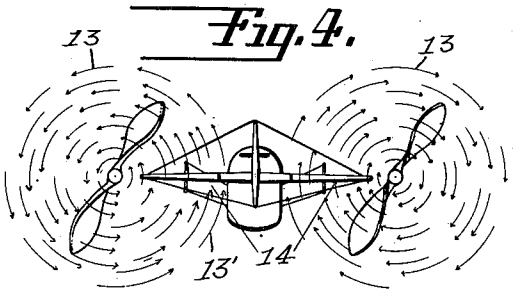
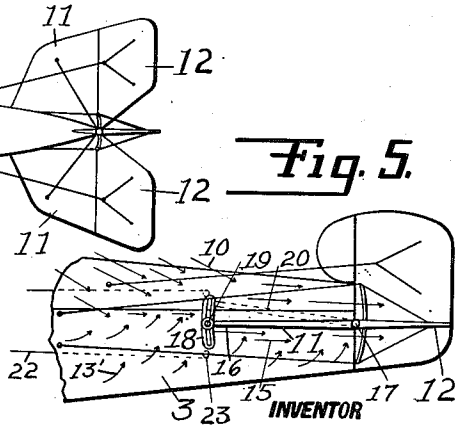



Fig. 5.




INVENTOR

LAWRENCE B. SPERRY.

BY

Herbert H. Thompson

ATTORNEY.

# UNITED STATES PATENT OFFICE.

LAWRENCE B. SPERRY, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE LAWRENCE SPERRY AIRCRAFT COMPANY, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## TWIN-PROPELLER AEROPLANE.

1,353,544. Specification of Letters Patent. Patented Sept. 21, 1920.

Application filed October 19, 1917. Serial No. 197,388.

*To all whom it may concern:*

Be it known that I, LAWRENCE B. SPERRY, a citizen of the United States of America, residing at 1505 Albemarle road, Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Twin-Propeller Aeroplanes, of which the following is a specification.

This invention relates to the stabilization of aeroplanes, not against sudden and natural atmospheric disturbances, but against the increase of depressing currents of air produced by the planes when the propeller or propellers are in rotation. These currents acting upon the elevating rudders of the craft exert an appreciable downward pressure on said rudders and on the tail of the machine, especially in the tractor type of biplanes, since the propeller accelerates the passage of air through the planes.

The object of the invention is to neutralize the downward pressure of the air in the immediate vicinity of the said rudders. The preferred manner in which this is done is fully pointed out in the following specification.

Referring to the drawings, Figure 1 is a side elevation of an aeroplane embodying my invention. Fig. 2 is a rear elevation of the same showing the position of the propellers and the method of mounting them. Fig. 3 is a top plan view of the same aeroplane. Fig. 4 is a diagrammatic view showing a modification in the relative position of the propellers and the elevating rudders. Fig. 5 is a detail showing a method of adjusting the horizontal tail plane. Fig. 6 shows a modified position of the tail planes.

My invention in its preferred form, is embodied in a multiple propeller tractor type of biplane. The driving motors 1 and 2 are shown mounted on either side of the body or fuselage 3 of the craft which is provided with upper and lower supporting wings 8 and 18. Said motors are provided with propellers 4 and 5. The propellers are oppositely pitched, and are designed to be revolved by the engines in opposite directions, with their inner tips 6 moving upwardly instead of downwardly, as is the usual practice. The motors 1 and 2 should preferably be placed near enough to the body 3 of the aeroplane, or be provided with large enough propellers, to cause the blades of the propellers to sweep close to the body of the aeroplane and comparatively closely together. The air striking the under side 7 of the upper wing 8 of the aeroplane, is deflected, so that as it leaves the rear part 9 of the wing, it takes a downward trend as indicated by the arrows 10, Fig. 1. This stream of air bears down on the horizontal tail surfaces 11, thus acting as a heavy weight on the rear end of the aeroplane. This necessitates the downward tilting of the elevating rudders 12, which are shown as pivoted at the rear of said tail pieces 11. But while the fore and aft balance of the aeroplane may be restored and maintained by operation of the controls by the aviator, this places a constant strain upon the aviator since the bearing of the elevating rudders is forward of the center of pressure, and also as will be seen, a braking effect will be exerted on the aeroplane by the rudders in this position.

It is to overcome these objections that I have adopted the arrangement and operation of propellers herein described.

The slip stream from a revolving propeller assumes the character of a helix of air as shown by the arrows 13. I propose to use the upward trend of this helix to neutralize the effect of the air currents 10 upon the horizontal tail planes 11 by pressing upwardly under said planes at 14, or by pressing upwardly on the air currents 10, so that the meeting of the upward currents 13′ and the downward currents 10 will produce a current 15 flowing straight back so as not to press either upwardly or downwardly on planes 11. In reality, both of these results are produced, so that the stabilization is effected partially by the upward pressure of currents 13′ on planes 11 and partially by the straightening out of currents 10. Means may also be provided for alining planes 11 with the currents 15 as shown by dotted lines 20, to secure the final adjustment. To this end, any suitable guides 19 on the ends 16 of planes 11 may be moved through a slotted member 18, and fastened in the desired position. This shifting of the inclination of planes 11 may, if desired, be placed under the control of the aviator, by means of a lever 21 near the aviator, having wires 22 connected thereto and passing over pulleys 23 and fastened to guides 19. The tail planes 11 are situated preferably midway

between the axes of revolution of the propellers, and as shown in Fig. 4, may be in substantially the same horizontal plane therewith. In reality, however, the propellers may be a little above or below this plane depending upon the depressing force of currents 10, which will vary under varying conditions, as for instance, with differently curved lifting planes.

In Fig. 6, I have shown the tail surface 11 and elevating rudder 12 supported by struts 24, in a position above the rear end of the fuselage or body 3 of the aeroplane. By this arrangement, the said surface and rudder may be removed from the influence of the depressing currents 10, and at the same time be acted upon by the upward whirl 13′ of the propeller slip streams, to a sufficient extent to counteract the effects of the depressing currents 10 upon the rear end of the fuselage 3. The distance of plane 11 and rudder 12 above the fuselage will of course vary according to the type of propellers being used, or the length of the propeller blades, or the power of the engines, under which conditions the lifting effect of the slip streams at a given relative point will vary. Also, the said plane 11 and rudder 12, instead of being removed entirely from the path of the depressing currents 10, may be located in said path at a point where the resultant of the meeting of currents 10 and 13′ have neither a depressing nor a lifting effect upon said plane and rudder, or preferably, where the said resultant causes a slight lifting of said plane and rudder, sufficient to counteract the aforesaid downward pressure of currents 10 on the fuselage.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I desire to secure by Letters Patent is:

1. In an aeroplane, a sustaining plane, a tail plane supported in the rear thereof and a pair of propellers positioned forward of said sustaining plane and on opposite sides of the fore and aft center-line of the aeroplane, said propellers being adapted to rotate in opposite directions with their inner tips moving upwardly, said propellers being so positioned that the upward whirl of the slip streams produced thereby will impinge the depressing currents produced by said sustaining plane adjacent said tail plane.

2. In an aeroplane, a sustaining plane, a tail plane supported in the rear thereof, a pair of propellers positioned forward of said sustaining plane and on opposite sides of the fore and aft center-line of the aeroplane, said propellers being adapted to rotate in opposite directions with their inner tips moving upwardly, said propellers being so positioned that the upward whirl of the slip streams produced thereby will impinge the depressing currents produced by said sustaining plane adjacent said tail plane, and means for shifting the fore and aft inclination of said tail plane.

3. In a tractor aeroplane, a supporting plane, a tail plane, means for neutralizing the downward pressure of air currents from said supporting plane on said tail plane, comprising a pair of oppositely pitched propellers and means for rotating said propellers in opposite directions with their inner tips moving upwardly, whereby the upward whirl from said propellers will meet said depressing currents adjacent said tail planes.

4. In a tractor aeroplane, a supporting plane, a tail plane, means for neutralizing the downward pressure of air currents from said supporting plane on said tail plane, comprising a pair of oppositely pitched propellers and means for rotating said propellers in opposite directions with their inner tips moving upwardly, said propellers being so positioned that the upward whirl therefrom will meet said depressing currents adjacent said tail planes.

5. In a tractor aeroplane, a supporting plane, a tail plane, a pair of oppositely pitched propellers, means for rotating said propellers in opposite directions with their inner tips moving upwardly, whereby the upward trend of the whirl from said propellers will impinge the lower surface of said tail plane, and means for shifting the angle of said tail plane, whereby the effect of the depressing currents from said supporting plane and the lifting effect of said upward trend of said whirl upon said tail plane may be equalized.

6. In an aeroplane, a supporting surface, a tail surface situated in the downwardly pressing currents from said supporting surface, and means for forcing a current of air upwardly against said tail surface for neutralizing the depressing effect of said downwardly pressing currents.

7. In a tractor aeroplane, the combination of a plurality of supporting surfaces, a fuselage, a pair of propellers adapted to be driven in opposite directions with their inner tips moving upwardly, and a horizontal tail surface on said fuselage positioned in the current resulting from the meeting of the depressing currents from

said supporting surfaces and the upward trend of the slip stream from said propellers, at a point where the lifting effect of said resulting current upon said tail surface is equal to the depressing effect of said depressing currents upon said fuselage.

8. In a tractor aeroplane, the combination of a supporting surface, a pair of propellers adapted to be driven in opposite directions with their inner tips moving upwardly, and a horizontal tail surface attached to said aeroplane in the current resulting from the meeting of the depressing currents from said supporting surfaces and the upward trend of the slip stream from said propellers.

9. In an aeroplane, a main supporting surface, a pair of propellers adapted to be rotated with their inner tips moving upwardly, and a stationary and a movable tail plane positioned on said aeroplane in the stream produced by the meeting of the depressed air currents from said supporting surface and the upward trend of the slip stream from said propellers.

In testimony whereof I have affixed my signature.

LAWRENCE B. SPERRY.