April 14, 1931. J. K. HARTMAN 1,800,794

CONTROL MEANS FOR AEROPLANES

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Fig. 9.

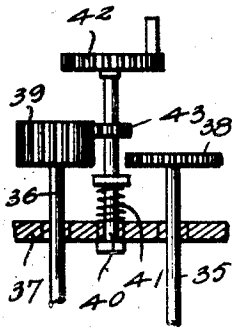
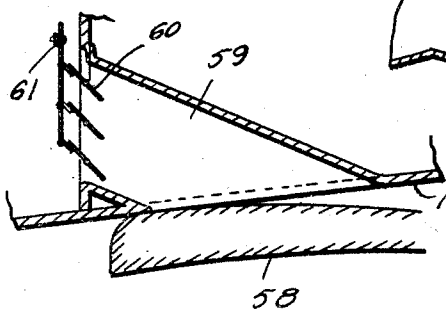


Fig. 1.

Fig. 7.

Fig. 3.

Fig. 8.



Inventor

J. K. Hartman

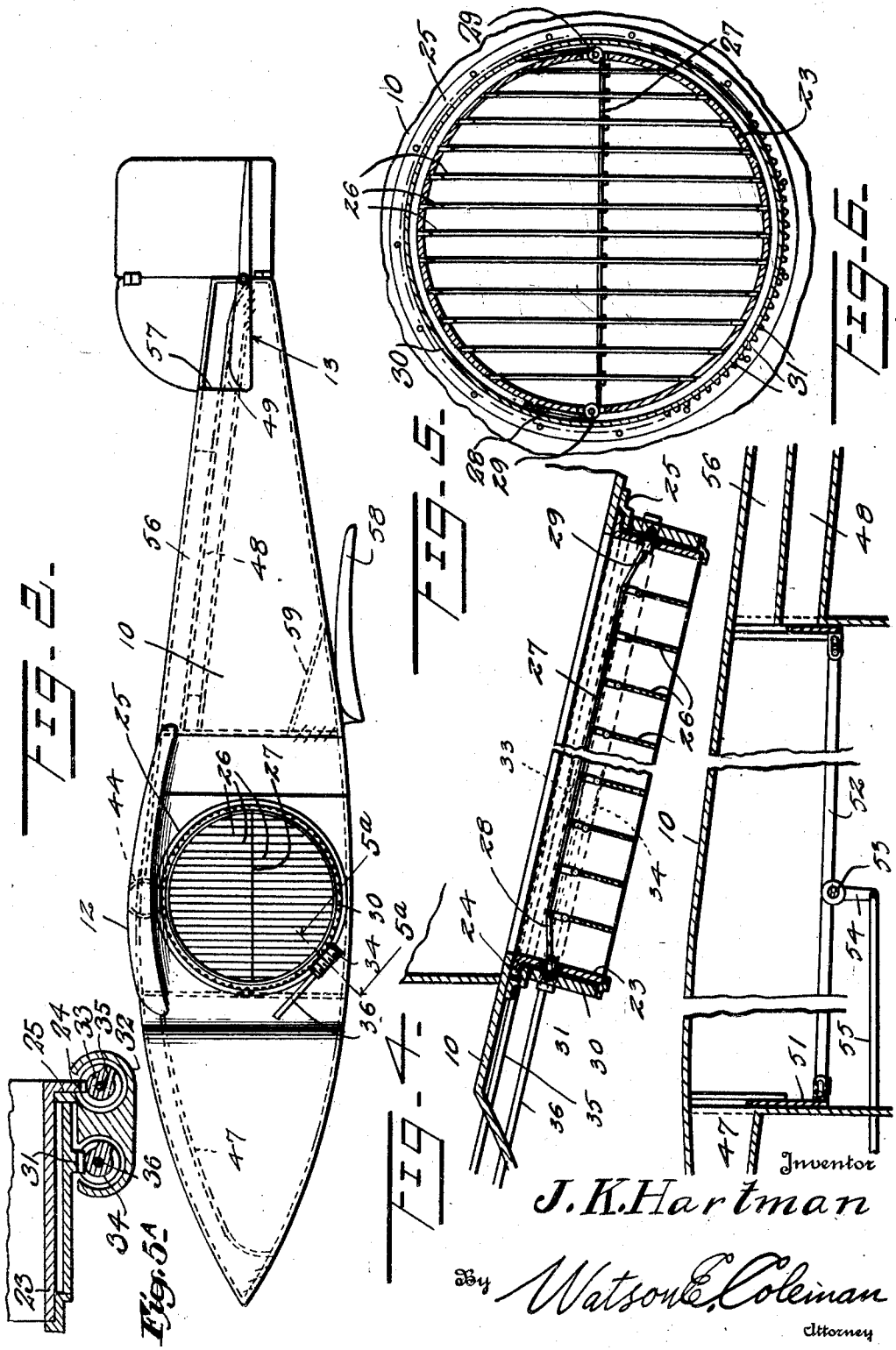
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April 14, 1931. J. K. HARTMAN 1,800,794

CONTROL MEANS FOR AEROPLANES

Filed Jan. 24, 1929 2 Sheets-Sheet. 2



Patented Apr. 14, 1931 1,800,794

UNITED STATES PATENT OFFICE

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CONTROL MEANS FOR AEROPLANES

Application filed January 24, 1929. Serial No. 334,798.

This invention relates to control means for aeroplanes, and more particularly to a construction providing for the use of air pressures in propelling the aeroplane and in controlling the various movements thereof.

An important object of the invention is to provide means for generating an air pressure and in intaking the air employed to produce this pressure in such manner that it may be utilized in controlling the plane by assisting in guiding the movements thereof and finally educting this air in a manner propelling the plane and further assisting in controlling the movements thereof.

A still further and more specific object of the invention is to provide a tunnel extending transversely of an aeroplane body having means for drawing air through opposite ends thereof and delivering this air in a manner propelling and controlling the plane, the ends of the tunnel being provided with means shiftable to control the direction of induction of air to the tunnel, so that the induction of the air may be employed to assist in propulsion to cause the body of the plane to elevate or lower or to check forward movement of the plane as desired.

These and other objects I attain by the construction shown in the accompanying drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention and wherein:—

Figure 1 is a plan view of an aeroplane embodying control means constructed in accordance with my invention;

Figure 2 is a side elevation thereof;

Figure 3 is a view partially in section through the control tunnel;

Figure 4 is a detail sectional view through one of the control elements at the end of the tunnel;

Figure 5 is a view partly in elevation and partly in vertical section of the means for controlling the passage of air into the tunnel;

Figure 5ª is a sectional view of the means for operating the controlling means, the section being taken on the plane indicated by the line 5ª—5ª of Figure 2;

Figure 6 is a longitudinal sectional view through the upper end of the tunnel illustrating the longitudinal ducts and the control means therefor;

Figure 7 is a fragmentary transverse sectional view showing a horizontal duct and the control element therefor;

Figure 8 is a detail sectional view through the lower portion of the tunnel showing the auxiliary lifting vane, supply duct and the control therefor;

Figure 9 is a detail view partly in section showing the control mechanism for the rotary shutters.

Referring now more particularly to the drawings, the numeral 10 generally designates the fuselage of an aeroplane, at present disclosed as having at its forward end an operator's cockpit 11. The plane is at present illustrated as of the monoplane type having supporting wings 12 and these wings, together with the empennage, generally designated at 13, may be, of any ordinary or usual construction, with the exception of details hereinafter more fully set forth.

In accordance with my invention, I form through the fuselage a transversely extending tunnel 14, the end walls 15 of which are apertured at 16 and diverge rearwardly. These end walls are preferably spaced apart at their rear ends a distance less than the transverse width of that portion of the fuselage with which they join and are connected thereto by rearwardly converging walls 17, for a purpose hereinafter set forth. Arranged within the tunnel is an engine 18 of any suitable type, the shaft of which, through transmissions 19, operates propellers 20 arranged immediately inwardly of the openings of the tunnel and in alignment therewith. Controls 21 for the transmission are extended through the forward wall of the tunnel and into convenient proximity to the operator's seat, designated at 22. The openings of the tunnel are each controlled by a rotating shutter structure including a main ring 23 having an outturned flange 24 at its inner end, which is formed as a worm gear. This flange is rotatably secured in position against the body of the plane by a retaining ring 25 of any suitable construction. Within the main ring are arranged a series of parallel vanes 26 con-

nected to one another, as at 27, for simultaneous operation. The vanes or shutters 26 are pivoted at their ends as at 26a, within the main ring 23.

The connection at its ends is, in turn, connected to the ends of a cable 28 passing over pulleys 29 mounted in the walls of the ring, so that the cable is extended to the exterior thereof. Surrounding the ring is a sleeve 30 having upon its periphery a gear 31. This sleeve is secured to the cable, so that when the sleeve is rotated, the positions of the vanes of the ring are simultaneously changed to vary the angle thereof.

The retaining ring mounts a casting 32 forming a combined bearing and guide for worms 33 and 34 meshing with the gear 24 and gear 31 respectively. Operating shafts 35 and 36 of these worms extend forwardly and upwardly and through the wall of the cockpit to a point adjacent the driver's seat, where they extend through a bearing structure 37. The shafts 35 and 36 at their inner ends are provided with gears 38 and 39, the gear 38 being relatively thin. The bearing structure 37 has rotatably and slidably directed therethrough a shaft 40, which is constantly urged outwardly by a spring 41. The outer end of this shaft has an operating wheel 42 and this shaft has fixed thereto a gear 43 which is constantly in mesh with the gear 39 of the shaft 36 or that shaft which controls the sleeve 30. By forcing the shaft 40 inwardly against the action of the spring 41, the gear 43 may be brought into simultaneous engagement with the gears 39 and 38, causing these gears to rotate in the same direction and at the same speed.

Attention is directed to the fact that both the sleeve 30 and ring 23 are locked against rotation by the engagement of the worms therewith, so that there will be no movement of either of these parts except when rotation is imparted thereto through the wheel 42.

It will be obvious that by simultaneously rotating the gears 38 and 39, the position of the register ring 23 may be changed without changing the position of the control slats thereof and that after a desired position of this ring has been attained, by allowing the shaft 40 to move outwardly and then continuing the rotation, the position of the control slats may be varied to suit the desires of the operator.

Extending longitudinally of each wing structure is a duct 44 terminating at its outer end in an outlet 45 opening downwardly through the bottom face of the wing and preferably controlled by spring shutters. The inner ends of these ducts communicate with the tunnel 14 and are controlled by oppositely moving valves 46, so that the amount of air delivered from the tunnel through either duct may be increased and the amount delivered to the other of the ducts simultaneously decreased to overcome the tendency to horizontal inclination. Extending forwardly from the tunnel and opening downwardly at its forward end through the forward end of the fuselage is a duct 47 while extending rearwardly from the tunnel is a duct 48, the rear end of which is branched, as at 49, extended into the stationary fins 50 of the empennage and open downwardly through the lower surface thereof. The inner ends of the ducts 47 and 48 are controlled by oppositely moving valves 51 connected by a lever 52 which is centrally pivoted upon a shaft 53.

This shaft is at present disclosed as having a crank arm 54 to which is connected an operating rod 55 extending into the cockpit. A similar arrangement suitably modified may be employed for controlling the valves 45 hereinbefore described.

A further duct 56 extends rearwardly from the tunnel, this duct being constantly open to the tunnel and at its rear end being formed as a flat funnel 57 delivering air over the upper surfaces of the horizontal fins of the empennage. Arranged beneath the body of the plane and rearwardly of the tunnel is an auxiliary lifting vane 58 and extending from the tunnel is a duct 59 opening over the forward edge of this auxiliary lifting vane. This duct at its tunnel end is controlled by shiftable shutters 60 having any convenient operating means, generally designated at 61, which is extended to the operator's cockpit.

In operation of the plane, the induction of air through the opposite ends of the tunnel may be employed to either provide traction, act as a brake, or to combine either its traction or braking functions with lifting or lowering functions. It will be obvious that if the control slats are vertically disposed and incline forwardly, air drawn into the tunnel will be taken from a point in advance of the forward ends of the tunnel. The area of low pressure thus created will cause a rush of air against the rearwardly converging walls 17, with the result that the aeroplane will be propelled not only by this pressure but by the suction effect produced.

With the control slats in this position, by arranging them so that they incline rearwardly, air will be drawn from the rear of the plane, thus producing a rearwardly disposed low pressure area and causing a rush of air from the front of the plane which, engaging against the rearwardly diverging walls of the tunnel end, will act as a brake. By horizontally disposing these shutters and drawing the air from beneath the plane, a low pressure area will be formed therebeneath, so that the plane will be rapidly lowered while, by drawing the air from a point above the shutters, this air will be drawn from above the plane and will have a tendency to lift the same. Obviously, by compounding these positions, these forces may be combined in

desired proportions in the control of the plane. By reversely operating the propellers of the tunnel, a suction force at one side may be opposed to an eduction force at the opposite side to assist in rotation of the plane. Longitudinal stability may be maintained through control of the ducts 47 and 48 while lateral stability thereof may be controlled through the wing ducts, as hereinbefore described. In landing the plane, by simultaneously ejecting air through the tunnels 44, 47 and 48, this landing may be effected very slowly, this being particularly true when, in combination with the blasts of air thus generated, the shutters are disposed to exercise a lifting effect on the plane. It will be obvious that at all times, ejection of air over the auxiliary lifting plane 58 will produce a lifting effect, since it will create an area of low pressure beneath this plane, giving the plane a tendency to rise.

With the controls just described, the usual plane controls may be combined wherever this is considered necessary or advisable. Attention is directed to the fact that after landing, the speed of the plane may be rapidly checked by reversing the propellers and drawing air into the tunnel through the rear end of the duct 56 and through the duct 59.

Since the construction hereinbefore set forth is capable of a certain range of change and modification without materially departing from the spirit of the invention, I do not limit myself to such specific structure except as hereinafter claimed.

I claim:—

1. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, adjustable shutter means at the ends of the tunnel for controlling the angle at which air is drawn into the tunnel at the ends thereof, said shutter means comprising a rotating supporting body having parallel shutter elements, means for rotating the supporting body to adjusted positions, and means operable in any adjusted position of the supporting means for controlling the rotated position of the shutter elements.

2. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, adjustable shutter means at the ends of the tunnel for controlling the angle at which air is drawn into the tunnel at the ends thereof, lifting vanes carried by said fuselage, and means for directing air from said tunnel over said lifting vanes to assist in elevating the fuselage.

3. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, and adjustable shutter means at the ends of the tunnel for controlling the angle at which air is drawn into the tunnel at the ends thereof, said shutters being arranged in forwardly convergent relation, the rear wall of the tunnel joining the body of the fuselage through rearwardly convergent walls.

4. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, rings rotatably surrounding the ends of the tunnel, parallel shutters carried by said rings and rotatable upon their axes to assume different angles in the rings, means for rotating the rings, and means operable to adjust the position of the shutters in any rotated position of the rings.

5. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, rings rotatably surrounding the ends of the tunnel, parallel shutters carried by said rings and rotatable upon their axes to assume different angles in the rings, means for rotating the rings, and means operable to adjust the position of the shutters in any rotated position of the rings, the adjusting means of said rings and shutters locking the rings and shutters against movement when not in operation.

6. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, rings rotatably surrounding the outer ends of the tunnel, parallel shutters carried by each ring and rotatable upon their axes to assume different positions in the rings, a sleeve surrounding each ring and operatively connected with said shutters thereof to angularly adjust the shutters as it is rotated upon the rings, means for simultaneously rotating either ring and its associated sleeve, and means for rotating the sleeves independently of the associated rings.

7. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, and conduits leading to the rear end of the fuselage and terminating in downwardly directed outlets, the inner ends of said conduits being in communication with the tunnel.

8. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at

opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, conduits leading to the rear end of the fuselage and terminating in downwardly directed outlets, the inner ends of said conduits being in communication with the tunnel, wings for said fuselage and conduits communicating at their inner ends with the tunnel and at their outer ends terminating in outlets opening downwardly through the lower surfaces of the wings.

9. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, and conduits leading to the rear end of the fuselage and terminating in downwardly directed outlets, the inner ends of said conduits being in communication with the tunnel, there being a further rearwardly directed conduit communicating at its forward end with the tunnel and at its rear end opening rearwardly of the fuselage.

10. In an aeroplane, a fuselage having a transversely extending tunnel, propellers at opposite ends of the tunnel, means for rotating said propellers, means for controlling the direction of rotation of the propellers, and conduits leading to the rear end of the fuselage and terminating in downwardly directed outlets, the inner ends of said conduits being in communication with the tunnel, there being a further rearwardly directed conduit communicating at its forward end with the tunnel and at its rear end opening rearwardly of the fuselage, the rear end of the fuselage being provided with an empennage of the usual construction, the rear end of the last named tunnel opening over the horizontal stationary elements of the empennage.

11. In an aeroplane, a fuselage having a tunnel provided with intake openings located in the sides of the fuselage, wings located wholly above said openings, and means for drawing air into the tunnel.

12. In an aeroplane, a fuselage having a tunnel provided with intake openings located in the sides of the fuselage, means for drawing air into the tunnel, and means adjustable to control the angle at which the air is drawn into the tunnel at the intake ends thereof.

13. In an aeroplane, a fuselage having a tunnel provided with intake openings located in the sides of the fuselage, wings located wholly above said openings, means for drawing air into the tunnel, and means adjustable to control the angle at which the air is drawn into the tunnel at the intake ends thereof.

14. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, and means for drawing air into the tunnel, the fuselage being provided with a duct having an intake opening communicating with the tunnel and having a discharge opening at the lower side of the front end of the fuselage.

15. In an aeroplane, a fuselage provided with a tunnel having intake openings located at the side of the fuselage, means for drawing air into the tunnel, the fuselage being provided with a duct having an intake end communicating with the tunnel and having a discharge end at the lower side of the front end of the fuselage, and means for regulating and controlling the communication between the tunnel and duct.

16. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, and wings provided with ducts having intake ends communicating with the tunnel and having discharge ends at corresponding surfaces and near the tips of the wings.

17. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, and wings provided with ducts having intake ends communicating with the tunnel and having discharge ends at corresponding surfaces and near the tips of the wings, and means for regulating and controlling the communication between the tunnel and ducts.

18. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, and an empennage having stationary fins, the fuselage and fins being provided with a duct having an intake end communicating with the tunnel and having discharge ends at corresponding surfaces of the fins.

19. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, an empennage having stationary fins, the fuselage and fins being provided with a duct having an intake end communicating with the tunnel and having discharge ends at corresponding surfaces of the fins, and means for regulating and controlling the passage of air from the tunnel to the duct.

20. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, and an empennage having horizontal fins, the fuselage being provided with a duct having an intake end communicating with the tunnel and having discharge ends arranged to deliver air over corresponding surfaces of the fins.

21. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, an empennage

having horizontal fins, the fuselage being provided with a duct having an intake end communicating with the tunnel and having discharge ends arranged to deliver air over corresponding surfaces of the fins, and means for regulating and controlling the passage of air from the tunnel to the duct.

22. In a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, and an auxiliary lifting vane located below the fuselage and rearwardly of the tunnel, the fuselage having a duct extending from the tunnel to the upper surface of the vane.

23. In a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, an auxiliary lifting vane located below the fuselage and rearwardly of the tunnel, the fuselage having a duct extending from the tunnel to the upper surface of the vane, and means for regulating and controlling the passage of air from the tunnel to the duct.

24. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, the fuselage being provided with a duct having an intake end communicating with the tunnel and having a discharge end at the lower side of the forward end of the fuselage, wings provided with ducts having intake ends communicating with the tunnel and having discharge ends arranged at corresponding surfaces of the wings and near the tips thereof, an empennage having stationary and adjustable fins, the fuselage and stationary fins being provided with a duct having an intake end communicating with the tunnel and having discharge ends at corresponding surfaces of the fins, the fuselage being provided with a duct having an intake end communicating with the tunnel and having discharge ends to deliver air over corresponding surfaces of the fins, an auxiliary lifting vane located below the fuselage and in rear of the tunnel, the fuselage being provided with a duct extending from the tunnel to the upper surface of the vane, and means for regulating and controlling the passage of air from the tunnel to the ducts.

25. In an aeroplane, a fuselage provided with a tunnel having intake openings located in the sides of the fuselage, means for drawing air into the tunnel, the fuselage being provided with a duct having an intake end communicating with the tunnel and having a discharge end at the lower side of the forward end of the fuselage, wings provided with ducts having intake ends communicating with the tunnel and having discharge ends arranged at corresponding surfaces of the wings and near the tips thereof, an empennage having stationary and adjustable fins, the fuselage and stationary fins being provided with a duct having an intake end communicating with the tunnel and having discharge ends at corresponding surfaces of the fins, the fuselage being provided with a duct having an intake end communicating with the tunnel and having discharge ends to deliver air over corresponding surfaces of the fins, an auxiliary lifting vane located below the fuselage and in rear of the tunnel, the fuselage being provided with a duct extending from the tunnel to the upper surface of the vane, means adjustable to control the angle at which the air is drawn into the tunnel at the intake ends thereof, and means for regulating and controlling the passage of air from the tunnel to the ducts.

In testimony whereof I hereunto affix my signature.

JOHN K. HARTMAN.