Fig.1.

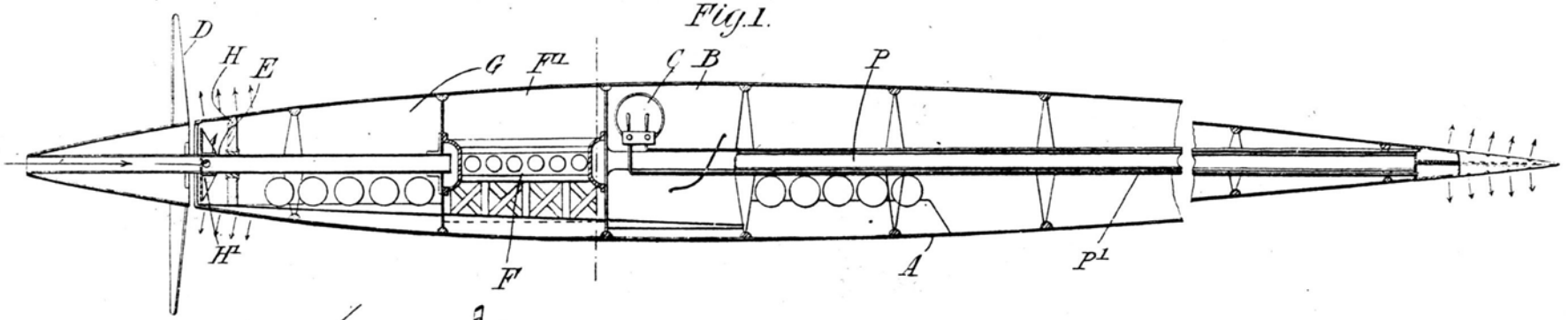


Fig.2.

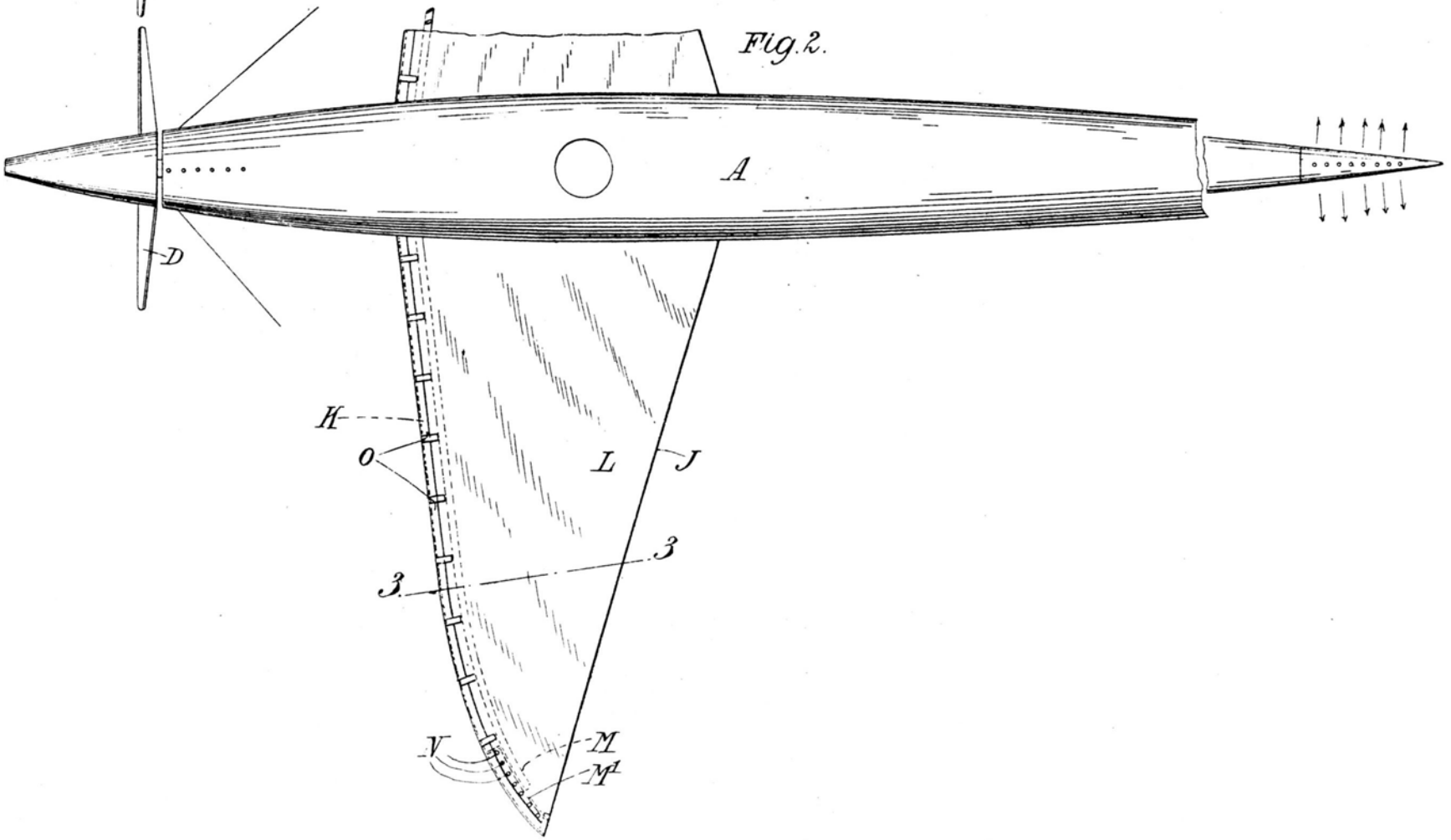
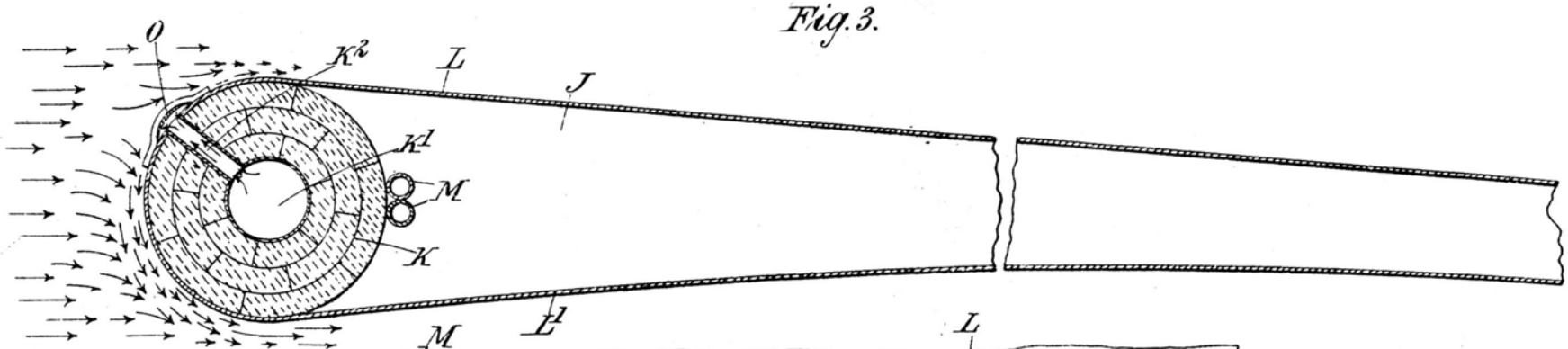


Fig. 3.



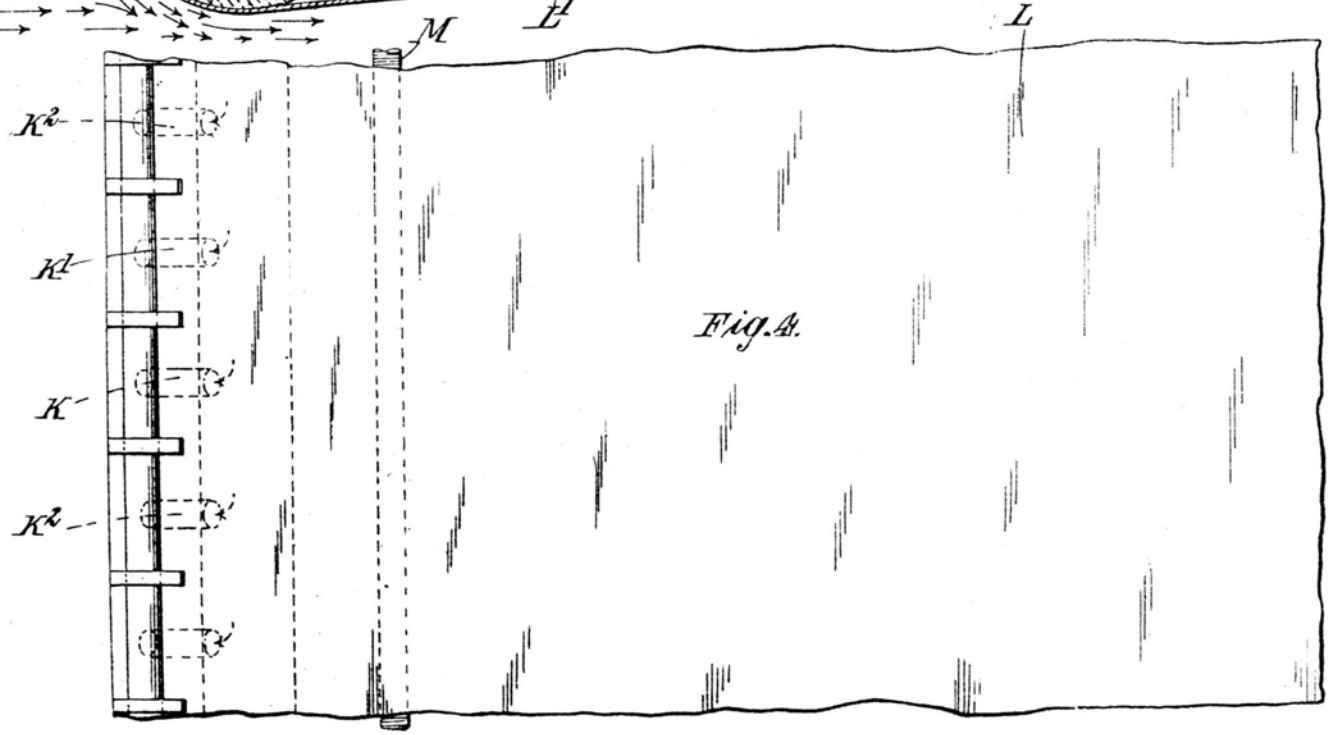


Fig. 4.

Fig. 5.

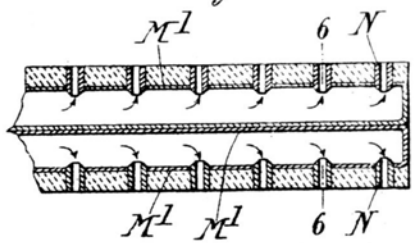
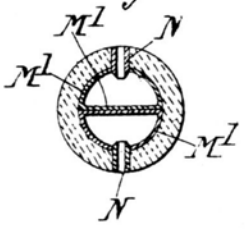


Fig. 6.



N° 11,784 A.D. 1911

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Complete Specification Left, 16th Dec., 1911—Accepted, 16th Aug., 1912

PROVISIONAL SPECIFICATION.

Improvements in or relating to Aeroplanes and the like.

I, ALEXANDER LIWENTAAL, Engineer, of 92, High Street, Islington, London, N., do hereby declare the nature of this invention to be as follows:—

This invention is for improvements in or relating to aeroplanes and the like and refers more particularly to a method of steering and balancing such machines.

According to this invention the steering or balancing of an aeroplane is carried into effect by the reaction effect of jets of compressed air or the like, and a construction for carrying into effect this invention comprises the combination with the lifting-planes of jets thereon for the issuance of compressed air or the like.

Preferably the jets are disposed above or below or both above and below the surfaces of the planes approximately at the tips thereof, and are directed in an upward or downward direction respectively.

A similar construction may be used, according to this invention, for steering an aeroplane and the construction comprises the combination with the tail of the machine of jets thereon for the issuance of compressed air or the like, the jets being arranged in a cruciform manner preferably at the tail end of the body.

The jets may be of any convenient form and the wings or lifting-planes of the machine are made preferably in a hollow form for the passage there-through of tubes conveying the compressed air or the like to the jets at the outer extremity.

The action of the jets of compressed gas may be controlled by valves governed automatically by pendulums, the action of which is as follows:—Should the aeroplane tilt a pendulum would alter its position thereby opening a valve controlling the supply to the jets required of compressed air, which issuing from the jets would cause a reactive force to act upon the planes whereby the aeroplane would be brought to its normal condition of balance, whereupon the pendulum would return to its normal position thereby closing the valve.

In an aeroplane constructed according to this invention the body is preferably made of a hollow cigar-shaped form and it is provided at the front end with a propeller shaft through which air enters into an air-tight compartment, the movement of the machine compressing air in the said compartment. The aeroplane may be provided with a fan rotating at a rate faster than the propeller shaft in order to give an additional pressure inside the air-tight compartment.

The body of the aeroplane preferably is provided with air compressors which take the air from the compressed air chamber and compress it to a still greater extent into suitable reservoirs. The aeronaut and machinery may be in chambers under a constant or variable pressure which may be regulated at will by admission and escape valves controlled automatically or by the aeronaut. The rear portion of the machine is provided with a "back-bone", that is, a strengthening device running the whole length of the machine at the rear of the aeronaut, as for example a hollow cylinder of metal constituting a reservoir for compressed air.

The aeroplane body may be provided at the front end with an air filter through which the air entering the hollow body of the machine has to pass. Such a filter is preferable in order to keep dust from the engine and the aeronaut. Dust

[*Price* 8*d*.]

getting to the engine is harmful in that it gets under the seating of the valves thereby preventing their efficient working and causing a loss of power.

One form of aeroplane according to this invention will now be described.

The body of the machine is preferably constructed in a cigar-shaped form. The interior of the body is divided and a compartment formed for the accommodation of the aeronaut, all levers and controlling devices being in the said compartment. The propeller is keyed or otherwise secured to a shaft at the front of the machine and driven by an engine situated in a compartment immediately in front of the aeronaut. The shaft carrying the propeller is hollow and communicates with a compressed air chamber in the machine so that the forward movement of the aeroplane forces air into the compartment and compresses it. The air passes through a filter as for example of woollen cords soaked in oil. There is provided also a fan which rotates at a speed higher than that at which the propeller shaft rotates, thereby giving a pressure inside the air-tight compartment. This air-tight compartment communicates with the aeronaut's compartment whereby the pressure therein may be kept constant at any value required by the use of valves controlled automatically or by the aeronaut at will.

The engine may be of any suitable type.

The planes of the machine preferably are not of the usual form, that is of the same width at all parts, but are of the shape of a bird's wings, that is wider at the point where joined to the body and tapering nearly to a point at the extreme end.

They are formed by a mast forming the fore ridge of the wing. Split bamboo in short strips are shaped and put together overlapping each other so as to give a thick dimension near the body and a small one near the tip and are glued together. The mast is bent and kept in shape by a sail cut and fixed to it, the sail being made of many fabrics glued together cross-ways. According to this construction both wings can be easily withdrawn and the mast can be unshipped. Preferably the mast is provided with a fore stay. The wings are constructed with an upper and a lower layer and between the two layers of fabric pass tubes of metal or other suitable material which end in jets projecting in a direction at right angles to and above the wing. Similar jets are provided on each wing and the tubes are connected to the compressed air reservoir.

In order to diminish the air resistance to the fore ridge of the wings, the masts are made hollow, and a lip is formed on the edge thereof, preferably a small distance above the centre, whereby the air is caused to flow in streams under the wing. The lip is so shaped to guide the air in a downward direction under the wing thereby preventing the formation of eddies and the like.

The portion of the aeroplane body behind the aeronaut is provided with a "back-bone" to stiffen it. The "back-bone" comprises a hollow cylinder of metal supplied with compressed air. The tail of the machine is provided with jets, similar to those provided on the wings or lifting planes, which point in directions at right angles to the tail. The jets are connected by tubes with the compressed air apparatus or reservoir.

The exhaust gases from the motor are preferably led out of the machine in a backward direction (and also possibly downwards) so that they help to propel the aeroplane.

The jets of air at the tips of the wings are controlled by valves which themselves are controlled by pendulums.

The action of such an aeroplane is as follows:—

Assume the machine to be flying and that a sudden gust of wind disturbs the balance of the aeroplane. As it tilts the pendulums controlling the valves of the air jets take up a new position and allow the valves to open. Thereby the jets are supplied with compressed air from the air compresser and issuing from the jets cause a reactive force to act upon the aeroplane thereby restoring it to its normal condition of balance. With an aeroplane provided with jets

on each wing both pointing in an upward direction the control would be such that in tilting in one direction the jets on one wing only are brought into action to restore it, but on tilting in the other direction the jets on the opposite wing are brought into action. It is to be understood, however, that jets may be provided both above and below the wings when the one set of pendulums would control the issuance of air from the jets pointing above on one wing and those pointing below on the opposite wing. Similarly another pendulum would control the other pair of jets. If wishing to alter his direction of flight the aeronaut opens the valves controlling the jets on one side of the tail, and the air issuing from the said jets causes a reactive force to act upon the rear portion of the machine thereby causing it to turn.

Though only one disposition of jets has been described it is to be understood that other dispositions would suffice to carry the invention into effect.

Dated this 16th day of May, 1911.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden, London, E.C.,
Chartered Patent Agents.

COMPLETE SPECIFICATION.

Improvements in or relating to Aeroplanes and the like.

I, ALEXANDER LIWENTAAL, Engineer, of 5, rue Louis-Ulbach, Courbevoie (Seine), France, formerly of 92, High Street, Islington, London, N., do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention is for improvements in or relating to aeroplanes and the like and refers more particularly to such machines as are steered and balanced by the use of jets of compressed air or other fluid.

According to this invention in an aeroplane steered or balanced by the reaction of jets of compressed air or the like, the construction comprises the combination with the planes of jets thereon for the issuance of compressed air or the like.

Preferably the jets are disposed above or below or both above and below the surfaces of the planes approximately at the tips thereof, and are directed in an upward or downward direction respectively.

A similar construction may be used, according to this invention, for steering an aeroplane to left or right or in an upward or downward direction and the construction comprises the combination with the tail of the machine of jets thereon for the issuance of compressed air or the like, the jets being arranged in a cruciform manner preferably at the tail and fore ends of the body.

The jets may be of any convenient form and the wings or lifting-planes of the machine are made preferably in a hollow form for the passage therethrough of tubes conveying the compressed air or the like to the jets at the outer extremity. The action of the jets of compressed gas may be controlled by valves governed automatically by pendulums or by the movement of mercury or like material, the action of which is as follows:—Should the aeroplane tilt a pendulum or mercury or like material would alter its position thereby opening a valve controlling the supply to the jets required of compressed air, which issuing from the jets would cause a reactive force to act upon the planes whereby the aeroplane would be brought to its normal condition of balance, whereupon the pendulum or mercury would return to its normal position thereby closing the valve.

In an aeroplane constructed according to this invention the body is preferably

made of a hollow cigar-shaped form and it is provided at the front end with a propeller shaft through which air enters into an air-tight compartment, the movement of the machine compressing air in the said compartment. The aeroplane may be provided with a rotating fan in order to give an additional pressure inside the air-tight compartment.

The body of the aeroplane preferably is provided with air compressors which take the air from the compressed air chamber and compress it to a still greater extent into suitable reservoirs. The aeronaut and machinery may be in chambers under a constant or variable pressure which may be regulated at will by admission and escape valves controlled automatically or by the aeronaut. The rear portion of the machine is provided with a "back-bone", that is, a strengthening device running the whole length of the machine at the rear of the aeronaut, as for example a hollow cylinder of metal constituting a reservoir for compressed air.

The aeroplane body may be provided at the front end with an air filter through which the air entering the hollow body of the machine has to pass. Such a filter is preferable in order to keep dust from the engine and the aeronaut. Dust getting to the engine is harmful in that it gets under the seating of the valves thereby preventing their efficient working and causing a loss of power.

One form of aeroplane according to this invention will now be described with reference to the accompanying drawings,

Figure 1 shows a sectional elevation of the aeroplane,

Figure 2 shows a wing in plan, and

Figure 3 a section on the line 3—3 of Figure 2.

Figure 4 is a plan of a portion of a wing showing the lip on the fore edge of the mast and the passages for the emission of compressed air from the mast.

Figure 5 is a section of one of the tubes with air jets at the tip of the wings, and

Figure 6 is a sectional view thereof on the line 6—6 of Figure 5.

Like letters refer to like parts throughout the drawings.

The body A of the machine is preferably constructed in a cigar-shaped form. The interior of the body is divided and a compartment B is formed for the accommodation of the aeronaut, all levers and controlling devices C being in the said compartment. The propeller D is keyed or otherwise secured to a shaft E and the front end of the machine is arranged to rotate therewith, being driven by an engine F situated in a compartment F^1 immediately in front of the aeronaut. The shaft E carrying the propeller is hollow and communicates with a compressed air chamber G or the chamber F^1 in the machine, so that the forward movement of the aeroplane forces air into the compartment and compresses it. The air passes through a filter H, as for example of woollen cords soaked in oil. There is provided also a fan H^1 which rotates at a speed higher than that at which the propeller shaft rotates, thereby giving a pressure inside the air-tight compartment G. This air-tight compartment communicates with the aeronaut's compartment whereby the pressure therein may be kept constant at any value required by the use of valves controlled automatically or by the aeronaut at will.

The engine may be of any suitable type.

The planes J of the machine shown in Figures 2 and 3 preferably are not of the usual form, that is of the same width at all parts, but are of the shape of a bird's wings—wider where joined to the body and tapering nearly to a point at the extreme end.

They are formed by a mast K forming the fore ridge of the wing, constructed of short strips of split bamboo shaped and put together over a tube or rod of steel or other material and overlapping each other (*i.e.* breaking joint) so as to give a thick dimension near the body and a small one near the tip and are glued together. The mast is then bent and kept in a curved form by a sail L L^1 cut and fixed to it, the sail being made of many fabrics glued together cross-ways. The construction is such that both wings can be easily withdrawn and the mast

can be unshipped. Preferably the mast is provided with a fore stay. The wings are constructed with an upper and lower layer L, L^1, and between the two layers of fabric pass tubes M of metal or bamboo or other suitable material which communicate with jets N formed on tubes M^1 inserted in the end of the mast K. The tubes M^1 extend for about three feet from the end of the mast K and the jets N discharge compressed air in a direction at right angles and above and below the wing. The two tubes M supplying compressed air to the jets above and below the wing are shown in Figures 2, 3, and 4 of the drawings. Similar jets are provided on each wing and the tubes are connected to the compressed air reservoir. The emission of compressed air from the jets is controlled by valves which preferably are placed at the end of the tubes situated in the aeronaut's compartment, so that he has them under control.

In order to diminish the resistance to the fore ridge of the wings, the masts K are made hollow and a lip O is formed on the edge thereof, preferably a small distance above the centre. The lip covers a series of passages K^2 connecting with the hollow centre K^1 of the mast K. Compressed air is supplied to the centre of the mast and is emitted through the passages K^2. The air impinges on the under side of the lip O and thereby is caused to flow in streams under and above the wing. The lip is so shaped to guide most of the air in a downward direction under the wing, thereby preventing the formation of eddies and the like.

The portion of the aeroplane body behind the aeronaut is provided with a "back-bone" P to stiffen it. The "back-bone" comprises a hollow cylinder of metal supplied with compressed air. The tail of the machine is provided with jets similar to those on the wings or lifting planes which point in directions at right angles to the axis of the tail or the stem. The four sets of jets may be connected by tubes P^1 with the compressed air apparatus or the reservoir P. Preferably the compressed air reservoir is supplied with air from a cylinder driven from the shaft of the engine and the air compressed is preferably taken from the chamber G where it is already under a small pressure due to the forward movement of the aeroplane.

The exhaust gases from the motor are preferably led out of the machine in a backward direction and also possibly downwards, so that they help to propel the aeroplane.

The jets of air at the tips of the wings are controlled by valves which themselves may be controlled by pendulums, mercury or like material.

Preferably jets for the issuance of compressed air are provided underneath the hull, so that if the aeroplane settles on water, the issuance of air from the jets will enable it to rise again more easily, or to glide on the surface of the water.

The action of such an aeroplane is as follows: Assume the machine to be flying and that a sudden gust of wind disturbs the balance of the aeroplane. As it tilts the pendulums or mercury or other material controlling the valves of the air jets take up a new position and allow the valves to open. Thereby the jets are supplied with compressed air from the air compresser and issuing from the jets cause a reactive force to act upon the aeroplane, thereby restoring it to its normal condition of balance. With an aeroplane provided with jets on each wing, both pointing in an upward direction, the control would be such that in tilting in one direction the jets on one wing only are brought into action to restore it, but on tilting in the other direction the jets on the opposite wing are brought into action. Should the wings be provided with two sets of jets, one in an upward direction and the other in a downward direction, one pendulum or set of pendulums would control the issuance of air from the jets pointing above on one wing, and those pointing below on the opposite wing. Similarly, another pendulum or set of pendulums would control the other air jets. If wishing to alter his direction of flight the aeronaut opens the valves controlling the jets on one side of the tail and the air issuing from the said jets causes a reactive force to act upon the rear portion of the machine thereby causing it to turn. Similarly, if he wishes to alter his altitude, he opens the valves controlling the jets either

above or below the tail, or stem thereby causing the machine to tilt and consequently to rise or fall in the air as required.

Though only one disposition of jets has been described, it is to be understood that other dispositions would suffice to carry the invention into effect.

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

1. In an aeroplane steered or balanced by the reaction of jets of compressed air or the like, a construction comprising the combination with the planes of jets thereon for the issuance of compressed air or the like.

2. A construction according to Claiming-clause No. 1, wherein the jets are disposed above, or below, or above and below, the surfaces of the planes at approximately the tips thereof and are directed in an upward or downward direction respectively.

3. In an aeroplane the combination with the tail or stem of jets thereon preferably cruciform for the issuance of compressed air or the like to react directly with the surrounding air.

4. In an aeroplane steered or balanced as described and having a hollow closed body the employment of a hollow propeller-shaft in the front of the body through which air enters into an air-tight chamber.

5. In an aeroplane according to Claiming-clause No. 4, the addition of a fan rotating at a rate faster than the propeller-shaft.

6. In an aeroplane according to Claiming-clause No. 5, placing the aeronaut and the machinery in chambers under a constant or variable pressure regulated at will by admission and escape valves controlled automatically or by the aeronaut.

7. In an aeroplane according to Claiming-clause No. 4 the provision of an air-reservoir constituting a "back-bone" for the machine.

8. In an aeroplane according to Claiming-clause No. 4 the provision of an air-filter in the front of the machine through which the entering air passes.

9. In an aeroplane according to Claiming-clause No. 1 constructing the wings of the machine in a hollow form for the passage therethrough of tubes conveying compressed air or the like to the jets.

10. In an aeroplane the provision of a lip on the fore edge of the wings so shaped to guide compressed air supplied through the hollow masts of the wings above and below the wings substantially as and for the purpose described.

11. The complete aeroplane substantially as described and illustrated in the accompanying drawings.

Dated this 16th day of December, 1911.

BOULT, WADE & TENNANT,
111/112, Hatton Garden, London, E.C.,
Chartered Patent Agents.

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