H. LA V. TWINING.

AIRSHIP.

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1,036,033.

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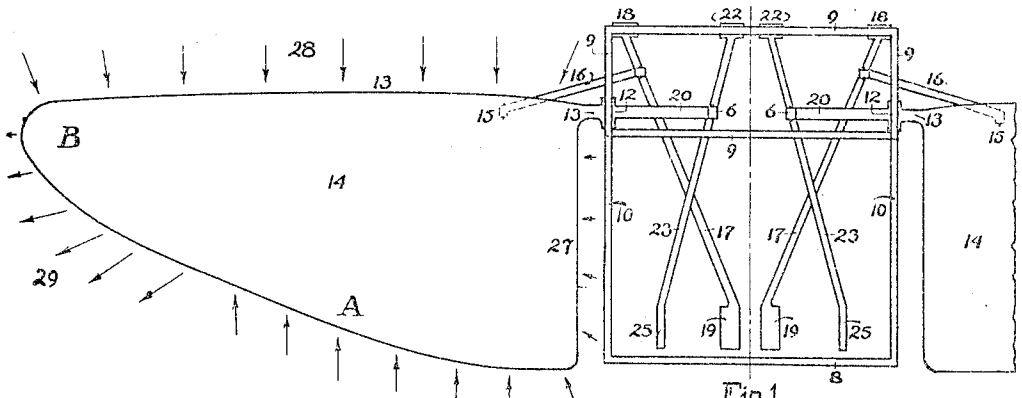

Fig. 1

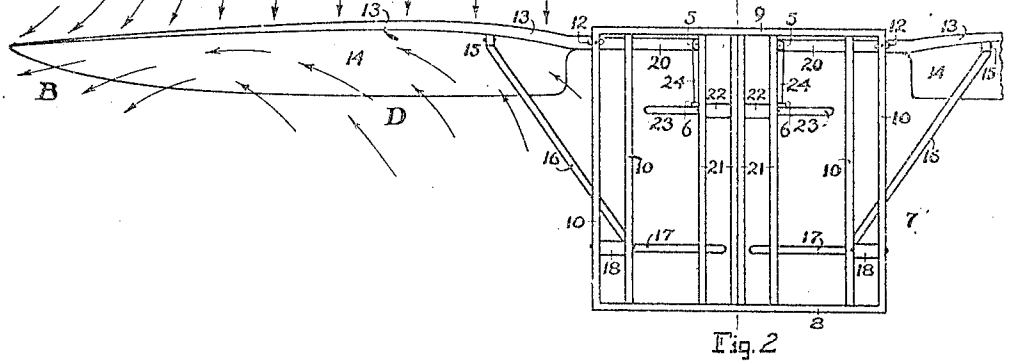

Fig. 2

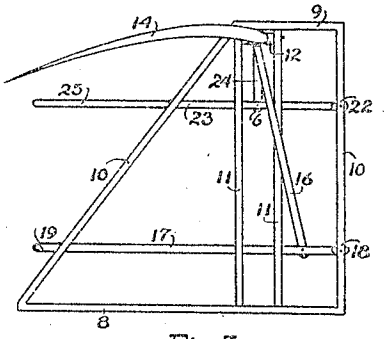

Fig. 3

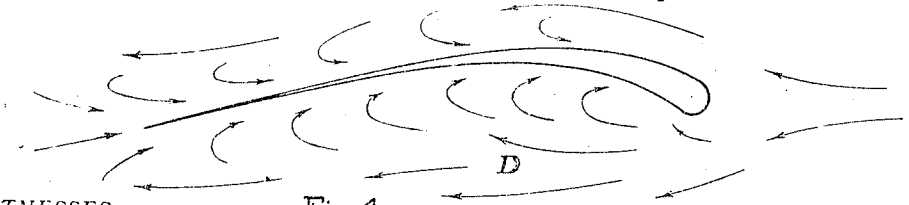

Fig. 4

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AIRSHIP.

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To all whom it may concern:

Be it known that I, HARRY LA VERNE TWINING, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented certain new and useful Improvements in Airships, of which the following is a specification.

My invention pertains to airships, and it has special reference to the type known as orthopters or aviplanes, constructed and operated on the principle of bird flight, in which launching and sailing is brought about and maintained wholly by the action of oscillating or beating wings, and wherein the stability both fore and aft and laterally shall be wholly under the control of the operator.

The object of my invention is first, to provide a structural arrangement of the frame and wings so that the hinged point of the wing at the frame will be forward of the weight, and whereby the operator in the frame may be able to so rock the frame fore and aft, while exerting a force against the wings, as to permit him to readily overcome any tendency to tilt forward, or to correct a downward pitch of the apparatus, while not in the least interfering with the manual operation of the machine. Second, in providing a peculiar shape and curvature of wings so as to provide for taking in the air along the whole anterior edge, and also along the inner end, and along a portion of the rear edge, during the upward and downward stroke, while on the other hand the air is expelled rearwardly and obliquely along only a portion of the posterior edge. Third, in the peculiar hinging of the wing joints with the frame at its upper end to facilitate maneuvering on the part of the operator. Fourth, a construction of levers, and their connection with the wings and body whereby not only the weight of the operator, but also his muscular power may be exerted to the utmost to impart energy to the wings, all of which will now be set forth in detail.

In the accompanying drawings, Figure 1 is a top or plan view of my improved airship. Fig. 2 is a view of the front end. Fig. 3 is a view of one side of the airship. Fig. 4 is a diagrammatic view of the wing formation, being a cross section of the wing at A in Fig. 1, showing the formation of eddies above and underneath the wing.

In the construction of my invention as herein shown, it is designed to be manually operated, but it is obvious that any suitable type of enginery may be employed as a motive power.

My principal object herein is to set forth the principles involved and to cover by later applications such mechanical structures as may be necessary to utilize the power employed.

In the present instance I provide a body in the form of a frame 7, preferably made rectangular in plan, the lower rectangle 8 being wider than the upper rectangle 9, these two elements being connected by posts 10. Near the forward end at each side is a pair of parallel posts 11 connecting the upper and lower rectangles, to serve as supports for the wing bearings 12, one of which rocks between each pair of posts. The wing arm 13 which projects beyond the body, carries the wing 14, and at a suitable point beyond the bearing 12 is a bearing 15, which by a ball and socket connects the dependent link 16 with a rearwardly-projecting foot lever 17. The forward end of the foot lever is attached to a bearing 18, between the two upright posts 10. The rear end of the foot lever bears the foot pedal 19.

Each bearing 12 has an inwardly projecting arm 20, so that these two ends 5 are substantially the same distance interiorly from the bearings 12 as the bearings 15 are beyond the bearings 12. The forward end of the hand levers 23 connect to a bearing 22, carried by two upright posts 21. The rear end of the hand levers 23 bear suitable handles 25. These levers pass beneath the inner ends 5 of arm 20, and an intervening link 24 connects the end 5 of arm 20 to the bearing 6 on hand lever 23. It will thus be seen that the hand levers are above the foot levers, and are so disposed that when the wings are horizontal, as shown in the figures, the body of the operator, when standing on the foot levers, is erect, with the hands grasping the hand levers.

In operating the apparatus the hands draw up the levers 23, and the weight of the body being thus wholly on the foot-levers an immense force can be exerted in the proper direction to cause a downward beat of the wings, causing the frame or body to rise, and as the downward movement on the foot levers is relaxed and the frame tends to fall the reaction of the air under the wings

supports the body from falling, precisely the same as in the case of a bird, which depends for sustaining itself in flight, so far as the purely vertical motion is concerned, on the two reactions thus obtained.

In order to more fully exemplify the action of the apparatus, it will be necessary to point out the structural arrangement and formation of the wings and their points of union with the frame.

The wing formation approximates the bird structure, but in a general way it may be observed that the anterior rib 13 projects out laterally from its bearing thus forming a straight edge. The wing, fore and aft, is greater at the hinged end, terminating at a narrow pointed end, with the posterior edge slightly curved. The forward rib is curved upwardly, and fore and aft the wing has also a curvature, shown substantially in Figs. 2 and 3, the rear edge, transversely, having a greater upward curvature than the front end when in action, due to the fact that while the forward edge is rigid the rear edge, midway between its ends has a flexure which in its physical action serves an important purpose. The upward flexure of the wing at its posterior edge is greater along that portion between A and B, Fig. 1. In this connection also it should be noted that the fore and aft rib 27, which forms the inner end of the wing, while it is rigidly attached to the anterior rib, will have more or less flexure in the direction of its movement, not however of as great an amplitude as the space between the rib 27 and the extreme outer end, and it is obvious that the degree of movement thus permissible is dependent on the weight of the operator and can only be determined experimentally. During the upward movement of the stroke of the wing, and while there is a progressively forward movement, the air passes beneath the wing at all points along the anterior edge as well as at the inner end of the wing, and also along a portion of the posterior edge, as indicated by the darts 28, in Fig. 1, but on the down stroke the flexure of the wing surface directs the air out obliquely, that is, the great mass of air confined beneath the wings, as shown by the darts 29. During the upstroke and downstroke of the wing the action of the air currents is represented by Figs. 1 and 2, in which it will be observed that, as the wing also moves forwardly, the air stream on the upper and under sides, flows to the tip of the wing B where it flows rearwardly and downwardly, at the rear edge, while a rolling stream D is formed beneath at the front edge, thus producing a reaction at both edges beneath, due, in a large measure, to the curved formation of the wing. The action of the wing, therefore, in its oscillating movement vertically, produces a rocking motion on a horizontal plane while in flight, whereby the physical action of the bird wing is simulated. It is to be observed that an area of low pressure is created by the vibrating wing, and that the air rushes toward the top of the wing and toward the under side of the wing, and out at the rear tip only, this result being secured by the peculiar shape of the wing together with its unique attachment to the frame. It is also obvious that the wings work independently, the one of the other, so that they can beat separately or in unison. As the anterior edge of the wing is attached to the front upper edge of the frame, the center of gravity of the frame is behind and below the point of attachment.

The operator stands on the pedals 19, grasping the hand levers 17 by the handles 25, which brings the center of gravity of the operator behind the attachment of the wing to the frame, thus bringing the center of gravity of the frame and operator working load behind the point of attachment of the wing to the frame. The hand and foot levers can be so adjusted vertically as to bring the center of gravity of the frame and operating load either above, below or in line with the point of attachment of the wing to the frame. In practice the levers are so arranged as to bring the center of gravity of the frame and operating load far enough below the point of attachment of the wing to the frame to secure the greatest fore and aft stability combined with the greatest sensitiveness of the machine. As the surface of the wing, projects rearwardly, unattached to the frame except at its anterior edge, it is obvious that the entire weight of the operator or working load is thrown upon the front edge of the wing through the levers and links, so that this weight combined with the muscular energy imparted through the hand and foot levers is exerted to drive the wings downwardly and upwardly, alternately. It is obvious that the down stroke of the wing develops a lift, and that the up stroke develops a downward pressure on the top of the wing, and unless the mechanical construction of the machine and the arrangement of its parts is such as to convert these reactions into forward thrust or drift, the machine would stay on the ground as a resultant of the lift and depression. Lift and forward thrust or drift are secured in this mechanism on both the up and down stroke of the wing by the structure and arrangement of parts as described above.

In order to more fully exemplify the action of the apparatus it is necessary to point out in detail the relation of the wings to the frame and the working load, which secures the desired result. The fore and aft width of the wing is such, as to bring the

center of pressure on the wings to the rear of the center of gravity of the frame and working load. This center of pressure on the wing, operating over the fore and aft width of the wing as one lever arm, the anterior edge of the wing and the frame being the fulcrum, and over the distance from the front edge of the machine to the center of gravity of the frame and working load, as a second lever arm, tends to rotate the center of gravity of the entirety in a path circumscribing the anterior edge of the wings as an axis. This rotation serves an important purpose. On the down stroke the pressure under the wings causes the entirety to rotate upward around the front edge of the wings and the frame, as an axis, developing a lift and causing the wing to assume a negative angle, thus presenting its under surface rearwardly. This brings about a rearward thrust and a forward drift. On the up stroke of the wings, the weight of the operator is thrown upon the hands, and a pull is exerted upward by the feet which are strapped to the pedals, and a push is exerted downward by the hands. This throws the weight of the operator and his muscular energy upon the front edge of the wing at 5 as shown in Fig. 2. This causes the wing to strike upwardly and develop a downward pressure upon the upper surface. This pressure, operating over the leverages above described, causes the center of gravity of the frame and working load to rotate downward around the front edge of the wings and frame as an axis, thus causing the wing to assume a positive angle, and to present its upper surface rearwardly, more or less. This rear presentation of the wing effects a backward thrust on the air, causing a forward drift of the machine. This forward movement causes the under surface of the wing to impinge upon the air, thus developing a lift. As a result of the peculiar construction of the mechanism and the arrangement of its parts, the beating of the wings causes the entirety to thus oscillate around the front edge of the wings and the frame, developing a lift and forward drift, both upon the up and down strokes, causing the entirety to pursue a sinuous path through the air. The rearward action of the wings upon the air, takes place largely toward the tips of the wings, this result being due to the triangular shape of the wings, and their fore and aft and lateral curvatures, which cause the air to roll toward the tip from the frame, and outwardly and rearwardly from the tip, while it flows in at all other points. It follows from the conformation of the wings above defined, that at all times in operation an area of low pressure is formed above the wings and an area of high pressure, relatively, is formed beneath the wings, producing strong lifting action.

It is obvious that lateral stability is secured by beating one wing faster than the other, when necessary, owing to increasing reactions upon the opposite side. Fore and aft stability is secured by shifting the center of gravity fore and aft, by shifting the hands along the hand levers, thus leaning the body fore or aft as the case may require.

What I claim as new, is:

1. In an airship, a body having a pair of transversely disposed wings hinged thereto, two foot levers, rigid links extending respectively from the foot levers to the wings at points outside the hinges thereof, two hand levers, and rigid links extending respectively from the hand levers to the wings at points inside the hinges thereof.

2. In an airship, a body having a pair of transversely disposed wings hinged thereto, two foot levers, links extending respectively from the foot levers at points intermediate of the ends thereof and to the wings at points outside the hinges thereof; and two hand levers connected to the wings at points intermediate of the ends of the hand levers.

3. In an airship, a body having a pair of transversely disposed wings hinged thereto, two independent foot levers, and links extending respectively from the foot levers at points intermediate of the ends thereof and to the wings at points outside the hinges thereof.

4. In an airship, a body having a pair of transversely disposed wings hinged thereto, two independent hand levers pivotally connected with the body, and links whereby the hand levers are connected to the wings at points intermediate of the ends of the hand levers.

5. In an airship, a body having a pair of transversely disposed wings hinged thereto, two foot levers, links extending respectively from the foot levers at points intermediate of the ends thereof and to the wings; and two hand levers connected to the wings at points intermediate of the ends of the hand levers.

Signed at the city of Los Angeles, State of California, this 18th day of February, 1909.

HARRY LA VERNE TWINING.

Witnesses:
F. R. HAWLEY,
J. S. ZERBE.