N° 11,332 A.D. 1910

(*Under International Convention.*)

Date claimed for Patent under Patents and Designs Act, 1907, being date of first Foreign Application (in the United States), 8th May, 1909

Date of Application (in the United Kingdom), 7th May, 1910

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

Accepted, 4th May, 1911

COMPLETE SPECIFICATION.

Improvements in Flying Devices.

I, Robert Day Andrews, Architect, of 50, Fisher Avenue, Brookline, Massachusetts, United States of America, do hereby declare the nature of my invention to be particularly described and ascertained in and by the following statement:—

The present invention relates to flying devices or apparatus and more particularly to the arrangement of the air resisting surfaces thereof.

Among other objects my invention provides an improvement in flying apparatus which is characterized by so spacing and downwardly converging main supporting surfaces in a fore and aft direction, and preferably also in a lateral direction, as to render said apparatus susceptible of ready flight and self righting both during and upon cessation of flight.

For the purpose of disclosing my invention, I have here illustrated it embodied in a kite, but it will be understood that it is applicable to gliders, aeroplanes and the like.

In the accompanying drawing:

Fig. 1 is a plan of a kite embodying my invention;

Fig. 2 is a side view of Fig. 1;

Fig. 3 is a view of Fig. 1 looking in the direction of the arrow on said fig.;

Fig. 4 is a view showing the device folded and furled; and

Figs. 5, 6, 7 and 8 are diagrammatic views to be referred to in describing the action of the kite in flight.

The kite herein shown as embodying my invention, comprises a surface or surfaces of air resisting sheet material 1 of silk or other suitable material having the general form of the frustum of a pyramid. The term "pyramid" is here used in its generic sense and includes not only a frusto-conical form but also all irregular as well as regular frusto-pyramidal forms.

The outline of the air resisting sheet of the kite herein shown forms two right triangles having a common hypotenuse. For a purpose hereinafter described this sheet is provided with a central hole or opening 2, the outline of which may be parallel to the outline of the sheet.

I will now describe one form of frame which may be conveniently used to

[*Price* 8*d.*]

bring or maintain said air resisting surfaces in the frusto-pyramidal form referred to. This frame includes a main longitudinal rib 3 secured medially to the kite surface. The kite surfaces or wings 4 lying on the opposite sides of said rib may be spread outwardly from the main rib by a transverse rib 5 crossing the latter at a point at a distance from its upper end herein equal to about a quarter of the length of said main rib. This transverse rib may be removably connected to the tips of the wings 4 by suitable fastenings such as rings 6 on said wing tips adapted to receive reduced ends of said rib. To contribute to the frusto-pyramidal form of the kite said wings are sloped upwardly (Fig. 3) from the central opening 2 referred to by the forcing apart or separation of said transverse rib from said main rib, herein by a short strut 7 hinged to the main rib and removably connected to said transverse rib 5 by a suitable fastening such as a ring 8 (Fig. 2) on said rib adapted to receive a reduced end of said strut. In thus separating the main and transverse ribs not only are the wings sloped upwardly but they are free to assume a natural curve when pressed by the wind or at other times without touching the transverse bar 5.

To further contribute to the frusto-pyramidal form of the kite surface, the surface portions appearing in the drawings as above and below the opening 2, and which may be designated fore and aft surfaces respectively, as well as the wings or lateral portions of said fore and aft surfaces should slope toward the central opening. To this end these fore and aft surfaces are herein sloped by the bending or arching of the main rib (Fig. 2) by the interposition of the strut 7 between the main and transverse ribs.

When the sheet is fastened to a frame consisting of the members described, the lateral wings would be drawn smoothly up at the opposite sides of the main rib with the lateral corners of the opening 2 receding from said main rib, but to give the air resisting sheet a more decided hopper or frusto-pyramidal form, these lateral corners preferably are not permitted to lie upward from said rib but are brought downward by connecting said lateral corners with the usual kite string by bridle cords (not shown) or as herein shown by a transverse spreader rib 9, herein resting loosely against the front of said main rib and removably supported by and attached to the opposite lateral edges of the sheet adjacent said opening by fastenings or rings 10 thereon adapted to receive reduced ends of said spreader rib.

It will be observed that in thus bringing forward the lateral corners adjacent the central opening all of the corners of the latter are brought into or maintained substantially in the same plane.

When the sheet is thus attached to its supporting frame its surface slopes variously upwardly and outwardly from the boundaries of the central opening to its outer edges thereby presenting a nose to the wind which deflects the air as more fully hereinafter described.

The kite string may be conveniently attached to a bridle 11 (Fig. 2) secured to the upper end of said main rib and at a point adjacent the middle thereof.

For ease in carrying and to occupy little space when not in use, the kite may be readily folded by removing the spreader rib, unfastening the strut from the transverse rib, and removing the wing tip rings from the reduced ends of said transverse rib. The main rib is then grasped centrally and held horizontally, whereupon the lateral wing surfaces will droop down side by side. The hinged strut may then be folded back against the main rib and the transverse rib and spreader are placed parallel to the main rib and the bundle of ribs thus formed rolled until the sheet is entirely furled. Unwrapping of the package thus formed is prevented by an elastic band or tying cord.

Having presented the construction of the illustrative device I will now describe its apparent action in flight, referring more particularly to the diagrammatic views 5, 6, 7 and 8. Referring to Fig. 5 it may be supposed that a plane such as A—B represents the fore surface of the kite and that said plane is placed at

an angle to the direction of movement of the air relative to it and we may consider that this relative movement of the air is occasioned by the action of the wind blowing in the direction of the arrow W. This plane being inclined to the direction of the wind causes a displacement of the air passing both below and above it, the air striking its under surface being deflected downward, thereby initiating an air wave whose course is indicated in a general way by the curved dotted lines *x*—*x* shown in said fig. At the same time the air passing directly above the plane will be drawn downward by the formation of a partial vacuum above the plane and will tend to move in a line paralleling the dotted wave line.

Now referring to Fig. 6 it may be supposed that C—D represents the after kite surface and that the planes A—B and C—D are maintained permanently in oblique relation to each other with a space or opening therebetween. The plane C—D will receive on its under surface the upward impulse of the air wave created by the plane A—B and upon its upper surface the parallel impulse of the air wave initiated above A—B.

If the planes A—B, C—D momentarily assume a position relative to the wind, such as is shown in Fig. 7, it is obvious that the air will pass by A—B without interference and will strike C—D upon its upper surface and thereby depress the latter and relatively force A—B upward into the position shown in Fig. 6. Should the planes A—B, C—D momentarily assume the position shown in Fig. 8 the upward pressure under the surface of C—D effected by the upward movement of the air wave created by the inclined plane A—B, will exceed that of the pressure upon the upper surface of C—D and will tend to lift D into the position shown in Fig. 6; for as the angle of A—B relative to the wind increases, the amount of deflected air increases and its upward force beneath C—D is correspondingly greater.

In other words, when the apparatus points increasingly downward below the horizontal as in Fig. 7, the vertical support offered by the aft surface C—D lessens more rapidly than that of the fore surface A—B and, conversely, when the apparatus points increasingly upward above the horizontal as shown in Fig. 8, the vertical support offered by the fore surface A—B lessens more rapidly than that of the aft surface C—D so that in both cases the downward pull of gravity (or of kite string) tends to restore the apparatus to a mean position (Fig. 6) whose horizontality is proportionate to the approach of the center of gravity of the apparatus to its center of support.

From the above statement it is clear that A—B, C—D as a whole, automatically returns to and must maintain a position varying little at any time from that shown in Fig. 6.

The space or opening intervening between the two surfaces occurs at that point in the air wave where the air set in downward motion by the fore surface comes to a stop in its vertical movement and thereafter begins to rise. At the moment of this cessation of vertical movement, the energy of the air's reaction is purely potential, and the spacing apart of the surfaces permits this potential energy a free opportunity to assume a kinetic form so that the air acquires an upward momentum or mass movement before reaching the aft surface in its course. Therefore this air strikes upon the aft surface as a wind blowing upward, and in this respect differs from the air meeting the fore surface, which has no vertical component. Upon this rising air the aft surface may glide horizontally without the aid of other propulsive force than that supplied by gravity, as a bird soars upon a rising wind without beating its wings.

The pull of the kite string, or, in case of a free and unattached apparatus the pull of gravity, is, of course, an important element in the matter of stability and is assumed as correctly placed in relation to the supporting surfaces.

The fore and aft planes as described give the kite an automatic equilibrium longitudinally or in the direction of the wind.

When to the fore and aft planes such as above shown and described, are con-

joined lateral planes, arranged in a similar relation of downward convergence toward said opening said lateral planes similarly give to the kite an automatic equilibrium transverse to the direction of the wind.

In the present embodiment of the invention the frame is constructed and arranged to co-operate with the surfaces in such a manner as to render them incapable of non-convergence.

The fore and aft planes and the lateral portions thereof which may be referred to as lateral planes, in sloping toward a central opening, produce a form which in its essential features is that of a shallow hopper or frustum of an inverted hollow pyramid or cone.

It is not essential in the assembling of these elements that the lateral planes be placed at the same level with the fore and aft planes for they may be above or below that level and equally well perform their intended service.

Nor is it essential to my invention that the above mentioned surfaces be limited to four or any other given number, or that the outlines of the surfaces be parallel to or at right angles to the longitudinal axis of the apparatus.

It will be understood that my invention is applicable to any type of aerial device, whether the relative movement of air with respect to the surfaces be obtained by the action of the wind against a kite or by driving the device through the air as by means carried thereby.

Heretofore, so far as I am aware, the stability and equilibrium of aeroplanes have been maintained only by the alertness and ability of the operative to meet every varying condition by the working of auxiliary rudders or other means, whereas by my invention the arrangement of planes is such that stability and equilibrium are obtained automatically by the structure itself.

By my invention is provided a device comprising an arrangement of planes, which will automatically adapt iself to any vagary or irregularity in the wind and when the wind dies down or its propelling power ceases, will not plunge to the earth to its destruction but will automatically maintain its equilibrium and float with stability gradually downward.

By my invention also, so far as I am aware, I am the first to recognize the value of the lifting force of the air wave caused by the displacement of an initial plane and to employ a secondary plane at a slope relative to the initial plane for the purpose of utilizing this force.

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. That improvement in flying apparatus which is characterized by so spacing and downwardly converging main supporting surfaces in a fore and aft direction as to render said apparatus susceptible of ready flight and self righting both during and upon cessation of flight.

2. A flying apparatus of the character referred to in Claim 1, wherein said main supporting surfaces converge downwardly in a lateral direction as well as in a fore and aft direction.

3. A flying apparatus of the character referred to in Claims 1 or 2, wherein means are provided to render said main supporting surfaces incapable of non-convergence.

4. A flying apparatus of the character referred to in Claims 1 or 2, wherein the sustained weight is so positioned relative to said main supporting surfaces as to receive substantial support therefrom and contribute to the self righting action thereof.

5. A flying apparatus of the character referred to in Claims 1 or 2 or 4, wherein the convergence and spacing of the surfaces is such that when the apparatus points increasingly downward below the horizontal the vertical support offered by an aft surface lessens more rapidly than that of a fore surface and, conversely, when the apparatus points increasingly upward above the hori-

zontal, the vertical support offered by the fore surface lessens more rapidly than that of the aft surface, so that in both cases the downward pull of gravity tends to restore the apparatus to a mean position whose horizontality is proportionate to the approach of the center of gravity of the apparatus to its center of support.

6. A flying apparatus of the character referred to in Claims 1 or 2, wherein the convergence and spacing of the surfaces is substantially such that the portion of the air passing above and rarified by a fore surface shall normally be received upon the upper face of an aft surface and the portion of the air passing below and compressed by said fore surface shall normally be received upon the under face of said aft surface, thereby exerting a maximum lifting force upon said aft surface.

7. A flying apparatus of the character referred to in Claims 1 or 2, wherein the surfaces are arranged in frusto-pyramidal form.

8. A flying apparatus constructed and arranged substantially as described with reference to the accompanying drawings.

Dated this 5th day of May, 1910.

PHILIP M. JUSTICE,
Chartered Patent Agent,
London,
For the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1911.

A.D. 1910. May 7. N° 11,332.
ANDREWS' Complete Specification.

(1 SHEET)

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

Fig. 1

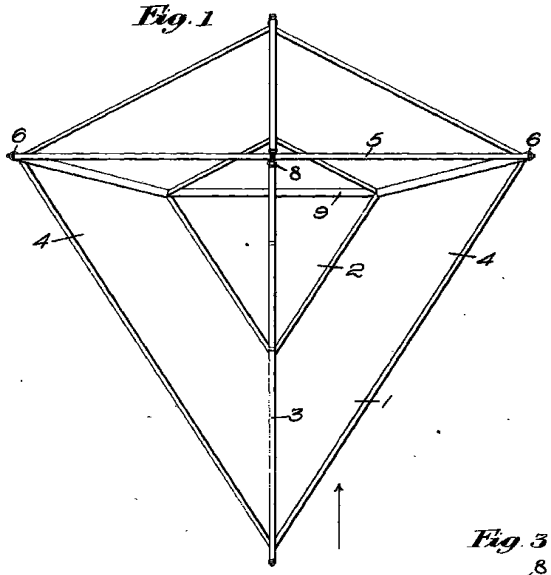

Fig. 2

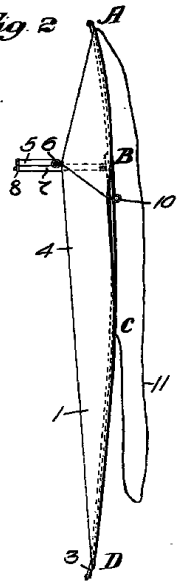

Fig. 4

Fig. 3

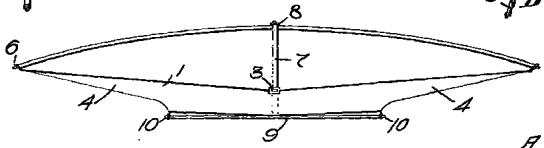

Fig. 5

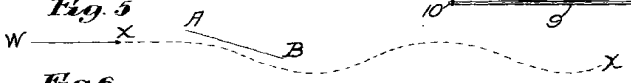

Fig. 6

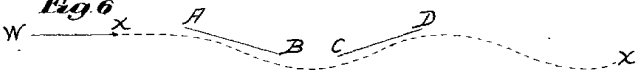

Fig. 7

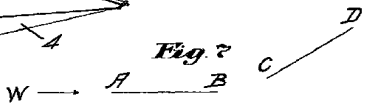

Fig. 8

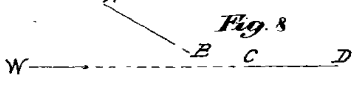

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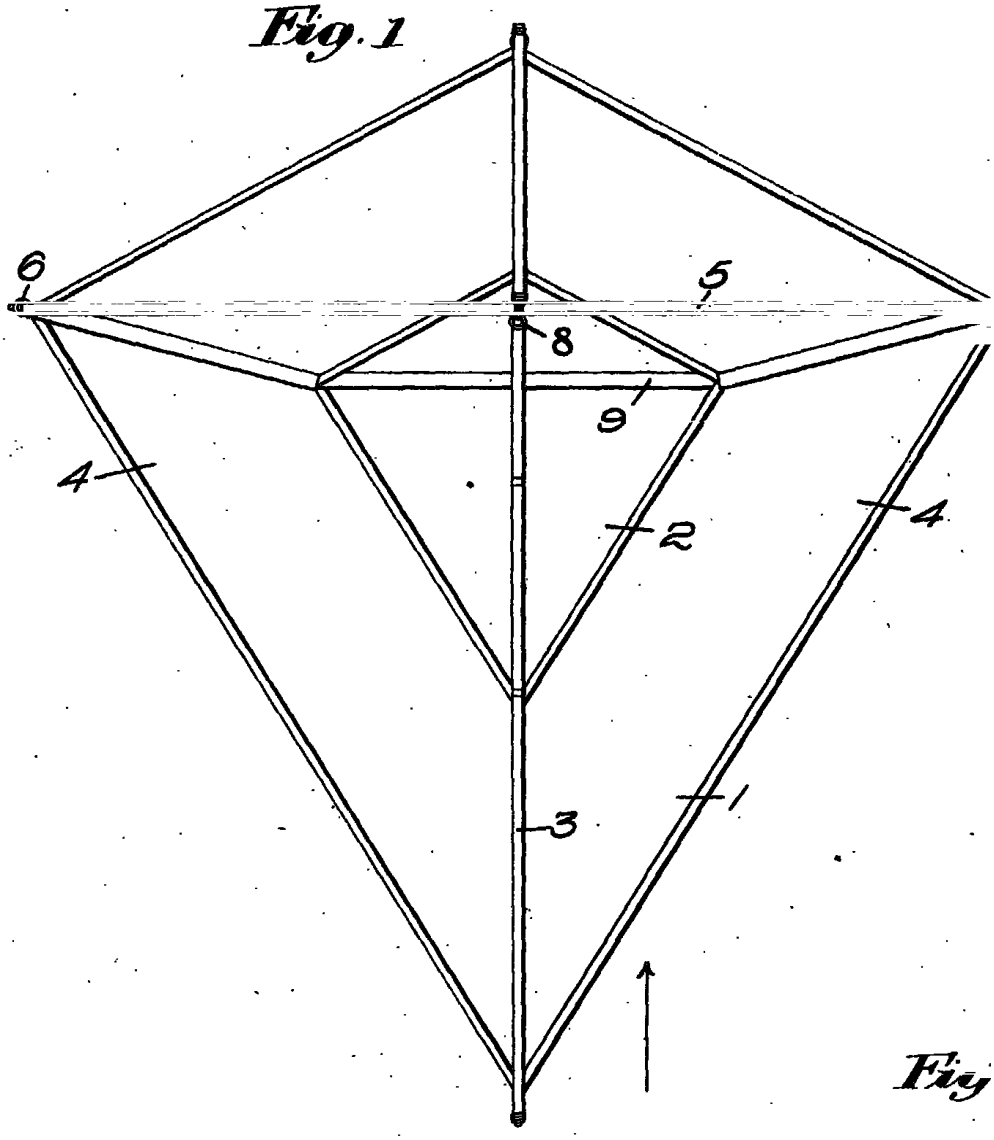
Fig. 1



Fig

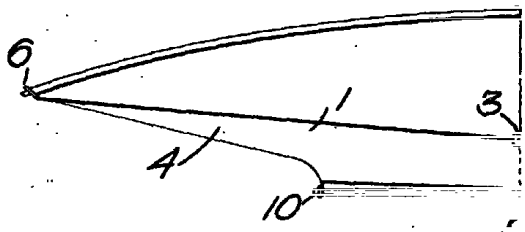


Fig. 5

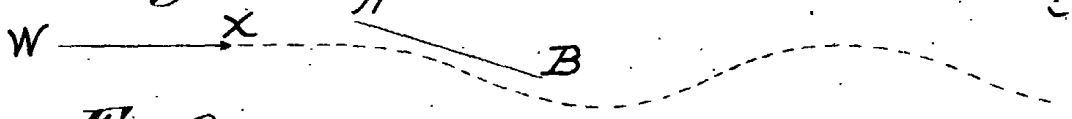


Fig. 6

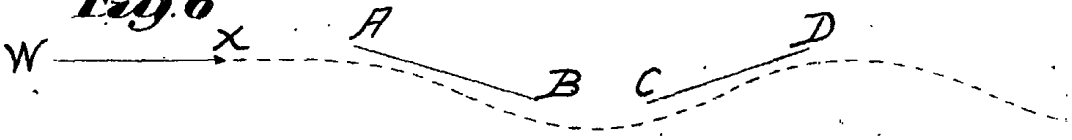


Fig. 2

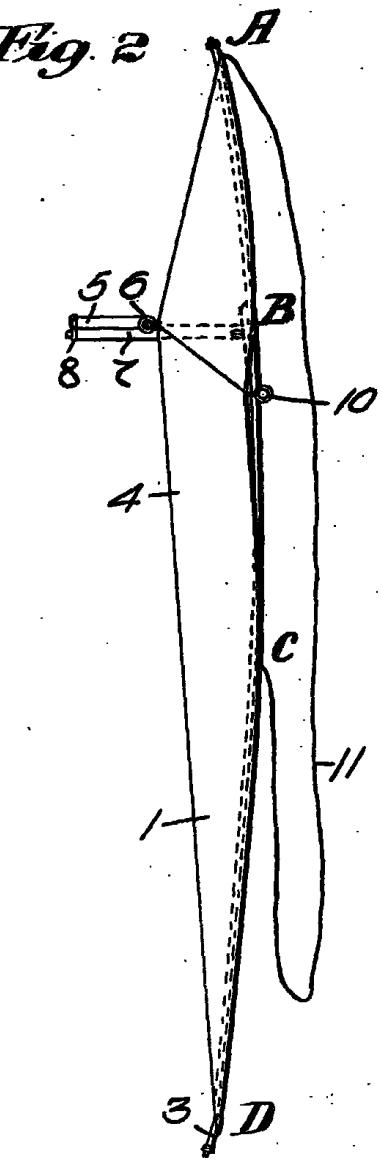


Fig. 4

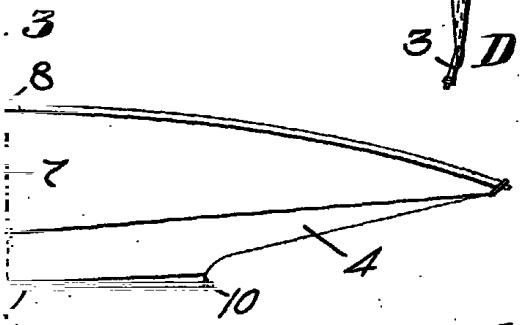


Fig. 7

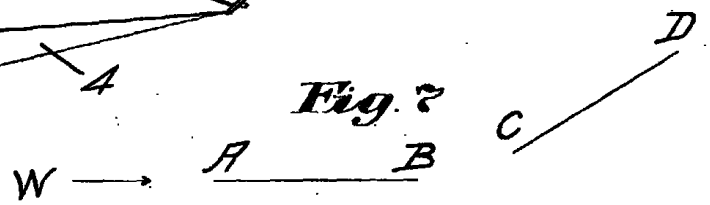
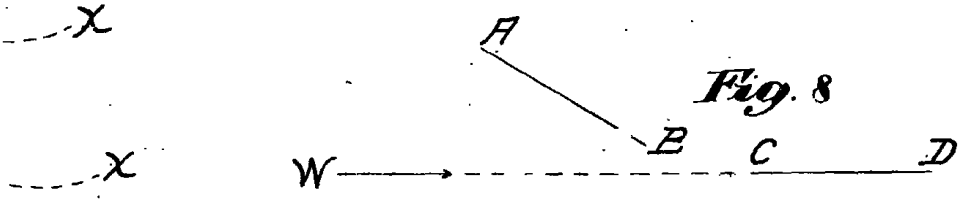


Fig. 8



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