Nov. 21, 1950 E. N. WINSLOW 2,530,641

KITE

Filed July 13, 1948

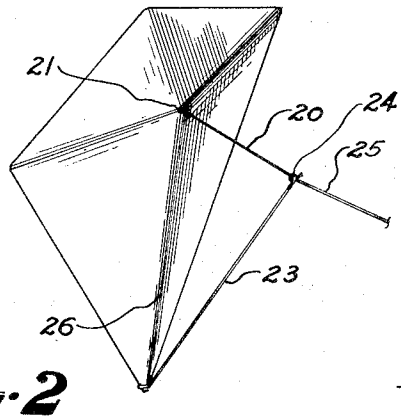


Fig. 2

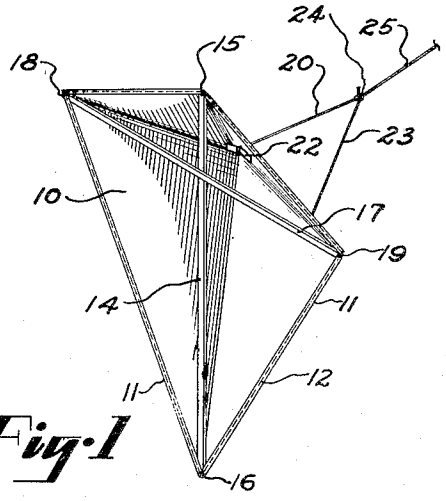
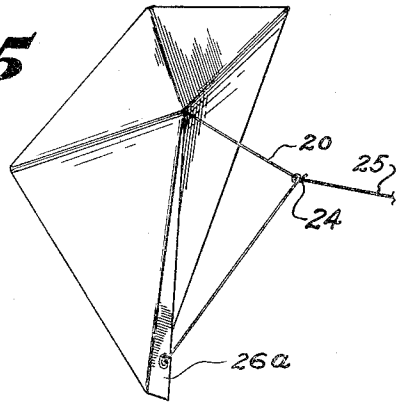


Fig. 1

Fig. 5



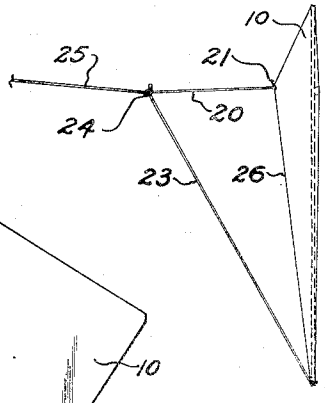


Fig. 3

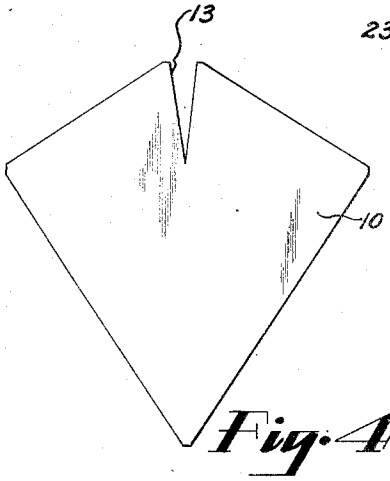


Fig. 4

INVENTOR.
EDWARD N. WINSLOW

BY
Fay, Golrick & Fay
ATTORNEYS

Patented Nov. 21, 1950 2,530,641

UNITED STATES PATENT OFFICE

2,530,641

KITE

Edward N. Winslow, Chagrin Falls, Ohio

Application July 13, 1948, Serial No. 38,422

6 Claims. (Cl. 244—153)

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This invention relates to improvements in tailless kites. More particularly, it is concerned with kites having preformed airfoil convexity and peripheral self tightening in flight.

The primary purposes of my invention are to provide a kite considerably lighter in weight than are those of conventional design, and one being possessed of improved airfoil efficiency.

Another purpose is to provide a kite the skin covering of which derives its taut convexity in flight primarily from wind pressure, the skin being unsupported intermediate its peripheral edges, as hereinafter more fully described.

A further purpose is to provide in a kite a transverse frame member, disposed to the lee of a longitudinal frame member and unattached thereto, that will yieldingly support the lateral extremities of the skin covering and at the same time tauten the periphery thereof by leeward planar distension.

To the accomplishment of the foregoing and related purposes, this invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain structures embodying the invention, said disclosed means constituting, however, but one of various forms in which the principles of the invention may be used.

In the drawings:

Fig. 1 is a rear view in perspective of the assembled kite in flight;

Fig. 2 is a front view in perspective;

Fig. 3 is a side elevation;

Fig. 4 is a plan view of the skin or covering sheet showing one form of V removal used to achieve pyramidoidal preconfiguration; and

Fig. 5 is a perspective view showing a form of V removal wherein the V is folded upon itself to form a forwardly projecting keel.

The principal structural features of a preferred form of my invention are best shown in Fig. 1. A polygonal sheet 10 of paper, thin rubberized or plastic sheeting, or other suitable material forms the skin covering. The edges of the sheet 10 are folded over as at 11 to provide a channel for a tensioned light string or filamentary element 12 which extends about the entire periphery of the sheet. The string 12 is contained within the secured fold of the sheet, but is not necessarily attached thereto, at least not in such a way that it cannot move slidably in the channel. Although normally a string will be used extending about the edges of a light paper sheet for tensioning effect and strength, it will be understood that if a reinforcing fold of sufficient strength is employed, the string may be omitted, and with stronger materials even the edge fold may be unnecessary.

The sheet 10 is preformed to have a concavo-

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convex contour. This preformation may be accomplished in a variety of ways, and in Fig. 4 there is shown a plan view of a sheet having a V cut 13 made therein from the upper top corner inwardly. The sides of the V will then be closed and will be glued together in lapped relationship, or a reinforcing strip may be secured to the sheet to hold the sides of the V in abutting relationship.

To achieve the pyramidoidal form shown in the drawings, a V may be formed at either the top or bottom corners of the sheet along the longitudinal axis, or two V's may be formed inwardly from the lateral corners of the sheet. The pyramidoidal form can be obtained, of course, by removing, lapping or box pleating the V, as mentioned above and this may be done at all four corners. The altitude of the pyramid may be controlled by the size of the V.

To support the base of the sheet longitudinally there is provided a longitudinal frame member 14 of wood or other suitable material attached at its ends 15 and 16 to the opposite most distant longitudinal extremities of the sheet. The ends 15 and 16 of the member 14 may be notched to engage the string 12 and the string may also be tied around one of the ends of the member 14 for additional security.

I have also provided a transversely extending frame member 17 to support the base of the sheet laterally of the longitudinal frame member. The ends 18 and 19 of the member 17 may also be notched and adapted to engage the tensioned string 12 at the lateral extremities of the sheet. To give additional durability and strength to the kite, the ends of the member 17 may be fitted in pockets of the sheet adjacent the lateral extremities, and may have the string 12 wrapped about the ends and tied thereto.

It should be emphasized here that frame members 14 and 17 are not attached to each other at any point, and are attached to sheet 10 or filamentary element 12 only at the longitudinal and lateral extremities of the kite. It will also be noted that the concavo-convex pyramidoidal contour of the sheet 10 gives the sheet a greater surface area than the planar area represented by the polygon 15—19—16—18. It is this latter polygon or base of the pyramidoidal sheet 10 that is stretched tautly by frame members 14 and 17.

In a non-flight status then, it will be clear that the flexible sheet 10 will have no definite convexity, since only the periphery of the flexible sheet will have an established form, with the sheet area intermediate the periphery hanging loosely on the frame outline.

To provide means by which the windward side of the sheet may be pulled into taut pyramidoidal form in order to have an effective airfoil, I have attached to the vertex 21 of the sheet a line 20. The end of the line 20 may be secured at the

vertex in any suitable manner, and in Fig. 1, by way of illustration, is passed through a small aperture in the vertex and tied about a bow 22 of folded paper extending transversely of the vertex on the leeward side. The bow or anchor 22 is glued to the sheet.

Another line 23 may be attached to the sheet along the longitudinal axis thereof below the vertex 21. I have found it satisfactory to attach this line 23 at the lower longitudinal extremity of the sheet and to wrap the line around the lower end 16 of the longitudinal frame member.

The lines 20 and 23 are shown joined at 24 to provide a flying harness for the kite. Attached at 24 is a ground control line 25.

Thus when the kite is put in flight, the force of the wind acting upon the airfoil surface of the kite will maintain the sheet 10 in taut pyramidoidal convexity since the ground control tension acting through the lines 20 and 25 will keep the vertex of the sheet fully projected windwardly at all times.

The pyramidoidal contour of the sheet 10 in flight possesses certain inherent advantages that must be mentioned. One is that all planing surfaces of the pyramidoidal airfoil are stretched taut and cannot slacken up or "pocket" because the vertex 21 is always fully projected. A second is that the longitudinal axis of the sheet from the vertex 21 to the lower extremity 16 form a keel or vertical stabilizer portion 26. I have found it advantageous to pre-crease this axis line of the sheet in order to form a clean, definitive leading edge for this vertical stabilizer portion.

Wind forces and thermal currents striking the planing surface of the kite will be split by the keel or stabilizer 26 and diverted to the edges of the kite by the lateral slanting surfaces of the sheet. Thus effective flying balance can be obtained without resort to auxiliary tail elements to reduce lateral diving tendencies frequently encountered in kites of conventional design.

Another advantage of particular importance in my improved kite is the unique relationship of the frame to each other and to the skin covering on sheet 10. In kites of conventional design, cross-members have heretofore been either attached to the longitudinal frame member at the point of intersection, or located windward of the longitudinal member, or one or both frame members are attached to the covering material of the kite. In all designs of this type, air pressure on the planing surface of the kite tends to exert a bending moment on the cross member of the ends against the center, which thus loosens the tension on the edges of the covering sheet, which in turn allows further bending.

In my kite, the transverse member 17 is not attached to the longitudinal frame member 14 and is disposed leewardly of it. The four ends of the frame members are merely attached to the filamentary element to put the peripheral edges of the sheet in tension.

Thus when the keel portion 26 of the sheet deflects wind forces to the lateral edges of the sheet by lateral corners of the sheet tend to be forced rearwardly. Such movement will increase the tension on the filamentary element 12 and tend to tighten the sheet edges. Any such movement of the lateral extremities of the sheet rearwardly due to increased air pressure on the planing surface (or lowered pressure on the leeward side of the sheet) will subject the transverse frame member 17 stress in compression. This automatic self-adjustment of the tension upon the string 12 by rearward movement of the member 17 helps keep the sheet 10 peripherally taut and thus permits smooth flow of air to the edges of the kite.

By way of illustration of a desirable relationship of the frame members and sheet in size, I have found that a satisfactory relationship is achieved when the length of the transverse frame member is approximately equal to or somewhat less than the longitudinal member, with the intersection of the members being approximately five sixths up the length of the longitudinal member. The altitude of the pyramidoidal sheet may be in the order of 1 to 6 or 1 to 5 in comparison to the length of the longitudinal and transverse members respectively. I have found it desirable to have the vertex of the sheet located directly windward of the intersection of the frame members as shown in Fig. 3.

One characteristic of the structural relationship described above is the unusual buoyancy achieved by the kite in flight. The kite's angle of attack as an airfoil is believed to be considerably less than that needed by most kites of conventional design, and its flying position approaches a vertical angle above the controller, with the angle of attack being somewhat similar to that of a conventional airplane wing.

While I have chosen to show the use of a two-line flying harness in connection with the kite, in a well-balanced, accurately proportioned model a single ground control line may be attached directly to the vertex of the sheet.

It will also be understood that while a quadrangular pyramidoidal form has been illustrated having two straight frame members crossing at right angles, other kite shapes may be used and other types of frame employed.

An alternate form of V removal is illustrated in Fig. 5 wherein the sides or opposite halves of the V are secured upon each other by suitable adhesive and projected forwardly to form a windwardly extending keel or vertical stabilizer 26a projecting from the vertex downwardly. Use of this form of preconfiguration of the sheet has been found to be practical in certain size and kite shapes and with certain material where downward distribution of weight is desired. When this form is utilized the lines 20 and 23 of the flying harness are attached to the vertex 21 and at a point on the keel intermediate the vertex and the lower extremity of the kite respectively.

The design of the invention embodying the features discussed above is such that the component elements may be very light, easily folded for packaging, quickly assembled for flight operations and both efficient and desirable as an airfoil.

It should be noted that one or more of the ends of the frame members may be detachably connected to the filamentary element so that the kite may be folded for suitable, partially assembled packaging. I have found that if the upper end of member 14 is thus detachably connected by notch engagement the additional feature of vertical adjustability is realized so that flying balance may be corrected if necessary.

Other modes of applying the principles of my invention may be employed instead of the one explained, change being made as regards the structure herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a kite, a flexible polygonal sheet of preformed concavo-convex pyramidoidal contour, means for stretching the periphery of the sheet into taut polygonal shape comprising a continuous filamentary element extending about the periphery of the sheet and secured thereto, a longitudinal frame structure attached at its ends to the opposite longitudinal extremities of the sheet, and a transverse frame structure attached at its ends to the opposite lateral extremities of the sheet, said transverse structure being disposed to the lee of the longitudinal structure and being translatable rearwardly relative to the longitudinal when wind forces in flight urge the lateral extremities of the sheet rearwardly, and a ground control line attached to the sheet at the vertex of the windward surface to maintain the sheet in taut pyramidoidal form in flight.

2. In a kite, a polygonal flexible sheet of preformed concavo-convex pyramidoidal contour, said sheet having a nonextensible, flexible, encircling, reinforcing edge portion, a longitudinal frame member attached at its ends to the opposite most distant longitudinal extremities of the sheet, a transverse member attached at its ends to the lateral extremities of the sheet, said transverse member being disposed to the lee of the longitudinal member and being translatable rearwardly relative to the longitudinal member, and, a ground control line attached to the sheet along the longitudinal axis thereof at the vertex of the pyramidoidal windward surface, and being adapted to maintain said windward side in substantially taut convexity.

3. In a kite, a flexible polygonal sheet having preformed windward planing surfaces of substantially pyramidoidal form, means disposed leewardly of the planing surface of the sheet for stretching the periphery of the sheet into taut polygonal shape, comprising; a continuous filamentary element extending about the periphery of the sheet and secured thereto; a longitudinal frame member detachably secured to the filamentary element at the opposite most distant longitudinal extremities of the sheet, a transverse frame member attached at its ends to the filamentary element at the opposite lateral extremities of the sheet, and a harness, having an attached ground line, for controlling the kite in flight, said harness being secured to the sheet at the vertex of the planing surfaces and being adapted to maintain the sheet in taut pyramidoidal form during flight, and being further attached to the sheet at a second point along the longitudinal axis thereof below the vertex.

4. In a kite, a polygonal flexible sheet having preformed windward planing surfaces of substantially pyramidoidal form, means disposed leewardly of the planing surfaces of the sheet for stretching the periphery of the sheet into taut polygonal shape, comprising; a continuous filamentary element extending about the periphery of the sheet and secured thereto; a longitudinal frame member detachably secured to the filamentary element at the opposite most distant longitudinal extremities of the sheet, a transverse frame member attached at its ends to the filamentary element at the opposite lateral extremities of the sheet, said transverse member being disposed to the lee of the longitudinal member and being translatable rearwardly relative to the longitudinal member, and a harness, having an attached ground line, for controlling the kite in flight, said harness being secured to the sheet at the vertex of the planing surfaces and being adapted to maintain the sheet in taut pyramidoidal form during flight, and being further attached to the sheet at a second point on the longitudinal axis thereof below the vertex, the vertex of the pyramid being located windward of the intersection of the longitudinal and transverse frame members.

5. In a kite, a flexible polygonal sheet of preformed concavo-convex pyramidoidal contour, the sheet being folded upon a line extending from the pyramid vertex toward the lower longitudinal extremity of the sheet, the confronting faces of the sheet adjacent the fold being attached together throughout a triangular area, the apex of which is coincident with the sheet vertex and the base of which projects windwardly from the sheet to provide a keel formation, means for stretching the periphery of the sheet into taut polygonal shape comprising a continuous filamentary element extending about the periphery of the sheet and secured thereto, a longitudinal frame member attached at its ends to the filamentary element at the opposite most distant longitudinal extremities of the sheet, and a transverse member attached at its ends to the filamentary element at the opposite lateral extremities of the sheet, said transverse member being disposed to the lee of the longitudinal member and being translatable rearwardly relative to the longitudinal member, and a ground control line attached to the sheet at the vertex of the windward surface to maintain the sheet in taut pyramidoidal form in flight.

6. In a kite, a flexible polygonal sheet having performed windward planing surfaces of substantially pyramidoidal form, and having a triangular keel formed thereon of the sheet itself converging upwardly to the vertex of the sheet and projecting windwardly of the planing surface, means disposed leewardly of the planing surface of the sheet for stretching the periphery of the sheet into taut polygonal shape, comprising; a continuous filamentary element extending about the periphery of the sheet and secured thereto; a longitudinal frame member detachably secured to the filamentary element at the opposite most distant longitudinal extremities of the sheet, a transverse frame member attached at its ends to the filamentary element at the opposite lateral extremities of the sheet, and a harness, having an attached ground line, for controlling the kite in flight, said harness being secured to the sheet at the vertex of the planing surfaces and being adapted to maintain the sheet in taut pyramidoidal form during flight, and being further attached to the keel at a second point along the longitudinal axis thereof below the vertex.

EDWARD N. WINSLOW.

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