March 22, 1966 W. B. CURTIS ETAL 3,241,793

KITES

Original Filed April 13, 1962 2 Sheets-Sheet 1

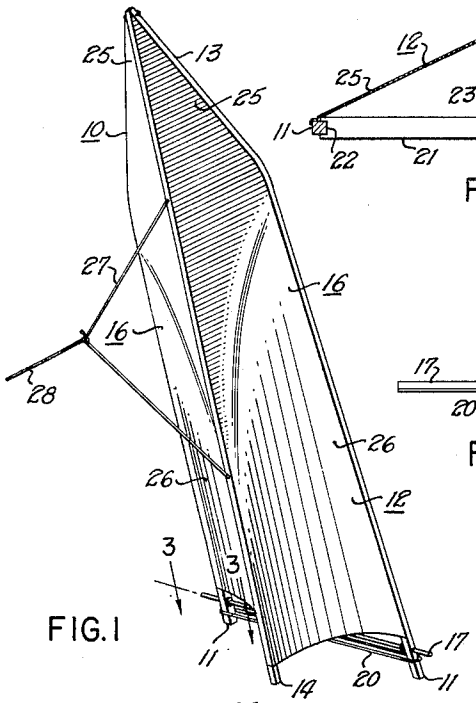


FIG. 1

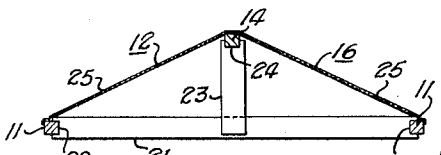


FIG. 4

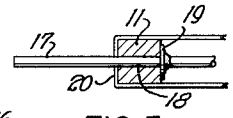


FIG. 3

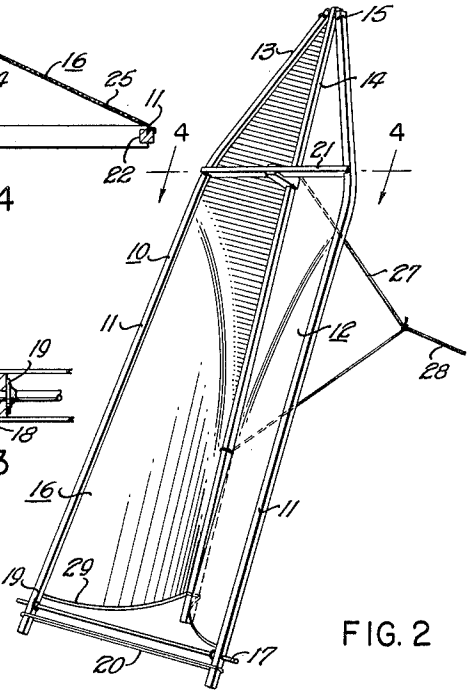


FIG. 2

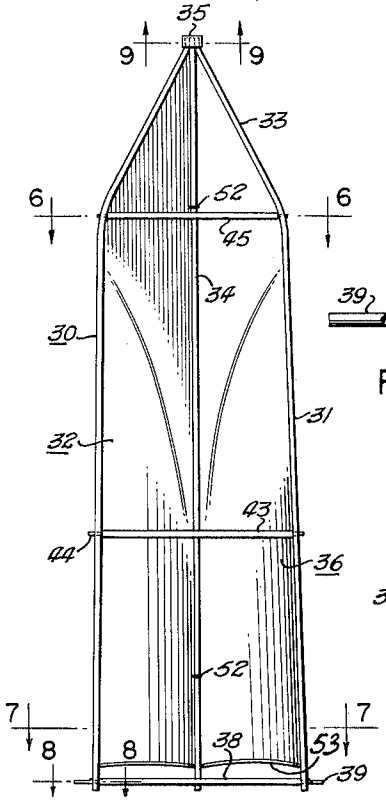


FIG. 5

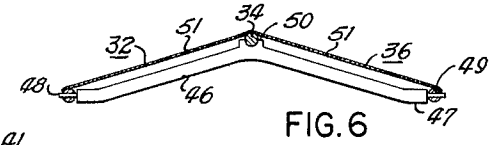


FIG. 6

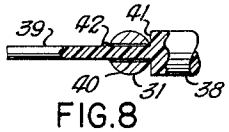


FIG. 8

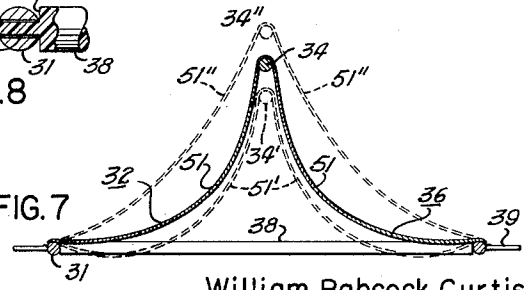


FIG. 7

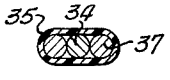


FIG. 9

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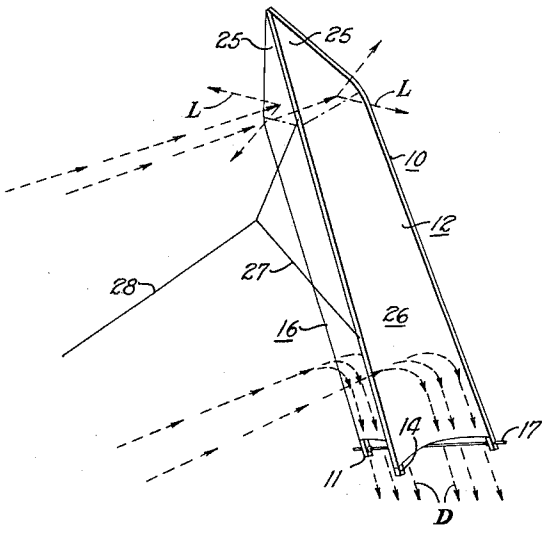



FIG. 10

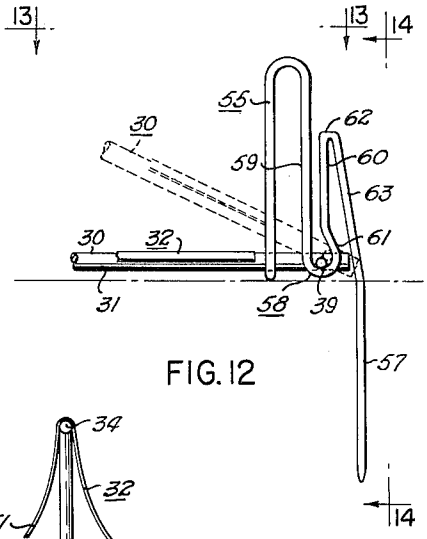



FIG. 12




FIG. 16

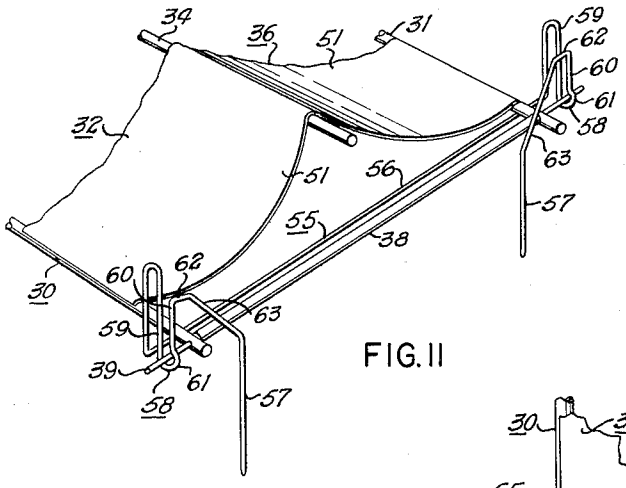



FIG. 11

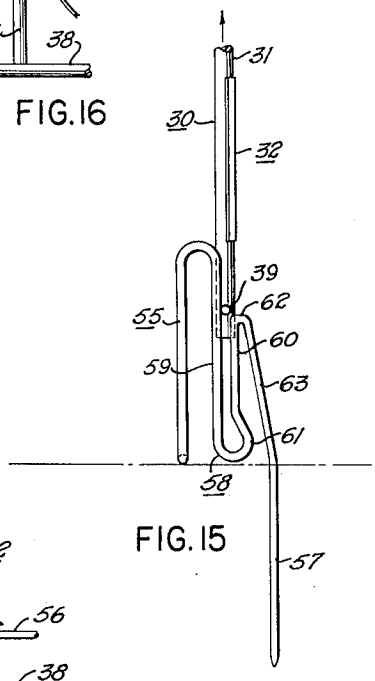



FIG. 15

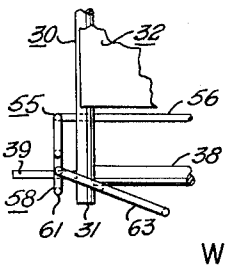



Fig. 13

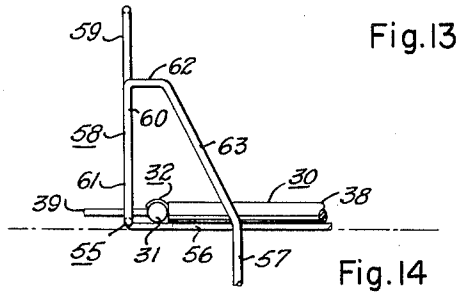



Fig. 14


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3,241,793

# KITES

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Continuation of application Ser. No. 187,343, Apr. 13, 1962. This application July 19, 1963, Ser. No. 296,899
24 Claims. (Cl. 244—153)

This application is a continuation of our copending application, Serial No. 187,343, filed April 13, 1962, now abandoned.

This invention relates to new and useful improvements in kites and more particularly to tailless kites.

One object of the invention is to provide an improved kite which is aerodynamically designed so as to be stable in flight and to ascend vertically instead of at the usual inclination and which has the appearance of a rocket or missile, especially, when climbing.

Another object of the invention is to provide an improved kite of oblong shape and of an aerodynamically low aspect ratio whereby the kite is stable in vertical flight and may have controlled instability to permit stunting thereof.

A particular object of the invention is to provide an improved kite of aerodynamic design and balance and of a shape and contour which permits the kite to fly in a true vertical position as well as stunting, turning on its side and looping of said kite when the position of its restraining string is altered longitudinally of said kite.

An important object of the invention is to provide an improved kite which is aerodynamically stable and of oblong shape with a dihedral nose or upper end portion and a lower portion of limited flexibility that increases downwardly of the kite whereby the wind or air currents are deflected laterally by the dihedral portion and downwardly by the lower portion so as to cause said kite to assume a vertical position when ascending.

Another object of the invention is to provide an improved kite of oblong shape having a major portion thereof capable of undergoing limited flexing longitudinally of the kite and adapted to deflect air currents longitudinally downward of said kite, the upper end portion of said kite being substantially rigid and of an angular transverse contour having converging margins so as to be substantially triangular and present dihedral surfaces for directing said kite vertically during climbing movement thereof.

A specific object of the invention is to provide an improved kite, of the character described, which is of inexpensive construction and which is so shaped aerodynamically that it undergoes movement from an air deflection type of flight to an airfoil type of flight when the kite string is released or slackened.

Another important object of the invention is to provide an improved kite of such construction that it may be launched automatically by the force of the wind when said kite is in a substantially vertical position and which will assume such position when released or permitted to ascend.

A further object of the invention is to provide an improvide kite, of the character described, having substantially rigid, longitudinal, marginal means extending throughout its length and held in spaced relationship by rigid, transverse means for supporting a cover or membrane, together with means that the lower end of the kite for coating engagement with a launchin gdevice for confining said kite in a prone position and permitting pivotal movement thereof to a vertical position for ascension in the manner of a missile or rocket whereby it is unnecessary to hold or run with said kite in launching the same.

Another object of the invention is to provide a novel launching device for coacting with a kite, of the character



described, and having means for confining the lower end of the kite while it is pivoted from a prone to a vertical position and permitting disengagement and lifting of the vertically positioned kite by the force of the wind.

Another object of the invention is to provide an improved kite, of the character described, having substantially rigid, longitudinal, central means coextensive with its length for coacting with the longitudinal marginal means in supporting the cover or membrane and dividing said cover into a pair of identical halves or sections extending longitudinally of the kite for reinforcing said cover and coacting therewith to form a pair of longitudinal channels or recesses for directing the wind or air currents downwardly of said kite.

Still another object of the invention is to provide an improved kite, of the character described, wherein the longitudinal central means may be restrained only at its upper portion so that its major portion is free to undergo flexing movement with the major portion of the cover of the kite or may be connected to one or more of the rigid transverse means so as to be relatively immovable.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, wherein examples of the invention are shown, and wherein:

FIG. 1 is a front, perspective view of a kite constructed in accordance with the invention and in vertical flying position,

FIG. 2 is a rear, perspective view, similar to FIG. 1,

FIG. 3 is an enlarged, transverse, sectional view, taken on the line 3—3 of FIG. 1 showing the top spreader in elevation,

FIG. 4 is an enlarged, transverse, sectional view, taken on the line 4—4 of FIG. 2,

FIG. 5 is a rear plan view of a slightly modified kite,

FIG. 6 is a view, similar to FIG. 4, taken on the line 6—6 of FIG. 5,

FIG. 7 is an enlarged, transverse, sectional view, taken on the line 7—7 of FIG. 5, showing the bottom spreader in elevation and the flexing movement of the lower end portion of the kite in broken lines,

FIG. 8 is a view, similar to FIG. 3, taken on the line 8—8 of FIG. 5,

FIG. 9 is an enlarged, transverse, sectional view, taken on the line 9—9 of FIG. 5,

FIG. 10 is a schematic view of the kite in vertical flying position and showing the direction of deflection of the wind or air currents,

FIG. 11 is an enlarged, perspective view of the lower end of the kite engaged with a launching device and in horizontal or prone position,

FIG. 12 is a side, elevational view of the launching device and the lower end of the kite in prone position, the initial launching movement of said kite being shown in broken lines,

FIG. 13 is a top plan view, taken on the line 13—13 of FIG. 12,

FIG. 14 is an elevational view, taken on the line 14—14 of FIG. 12,

FIG. 15 is a view, similar to FIG. 12, showing the kite in vertical position and disengaged from the launching device, and

FIG. 16 is a fragmentary, elevational view of the medial portion of a modified bottom spreader attached to the central stringer.

In the drawings, the numeral 10 designates an oblong, relatively-narrow kite having a pair of elongate frame members, rods, sticks or stringers 11 at its longitudinal margins for supporting a cover or membrane 12 of paper,

plastics, foil, cloth or other suitable flexible material. Preferably, the stringers **11** (FIG. 2) are substantially rigid, coextensive with the length of the kite and have converging upper end portions **13** whereby the upper end portion of said kite is substantially triangular. It is noted, however, that this triangular shape is not essential since the kite upper end portion could be arced or bowed instead of terminating in an apex. Also, as will be explained, the stringers may terminate short of the upper end of the kite. An elongate central member, rod, stick or stringer **14**, of substantially the same length, is disposed medially between the stringers **11** and the upper ends of all three stringers are attached by a suitable fastener **15** so as to be in engagement. The cover **12** is secured by an adhesive or other suitable means to the stringers **11** and **14** and may terminate above the lower ends thereof. Due to the medial disposition of the stringer **14**, the kite and/or its cover is divided into a pair of identical longitudinal halves or sections **16**. It is noted that the stringers may be formed of wood, plastics, metal or other suitable material having sufficient rigidity and strength and may be rectangular or square in cross-section (FIGS. 3 and 4).

A rigid, transverse member, crossbar or spreader **17**, of metal, wood or other suitable material, extends between the lower end portions of the marginal stringers **11**, at or below the lower end of the cover **12**. As shown most clearly in FIG. 3, each end of the crossbar **17** may project through and beyond a complementary, transverse opening **18** in each of the marginal stringers and may have an enlargement or shoulder **19** thereon for bearing against the inner surface of each stringer to maintain said stringers in spaced relationship. Preferably, the crossbar and openings **18** are cylindrical and the enlargements **19** of said rod are in the form of collars or annular disks secured to said rod. For coacting with the enlargements, a rubber band **20** extends around and between the lower end portions of the stringers **11** so as to urge said stringers into engagement with said enlargements. It is pointed out that the rubber band provides an inexpensive fastening means and that any adequate fastener may be employed to hold the stringers engaged with the enlargements **19**. Preferably, the fastening means is detachable so as to permit removal of the crossbar **17** and folding or collapsing of the kite for compact packaging and/or storage. As shown in FIGS. 1 and 2, the lower end of the center stringer **14** is spaced from and may be free of connection with the crossbar; however, as shown in FIG. **16** and as will be explained, said center stringer may be attached to said crossbar. If the marginal stringers are not sufficiently rigid, one or more additional crossbars or spreaders may be provided.

Another rigid, transverse member, crossbar or spreader **21**, of a material similar to the stringer material, extends between the marginal stringers **11**, at or slightly above the lower extremities of their converging upper end portions **13**. Each end of the spreader **21** has a notch **22** therein complementary to the cross-sectional shape of the stringers for receiving the same (FIG. 4). If desired, the spreader may be of slightly less length than the crossbar **17** so that the marginal stringers may not be exactly parallel and may diverge downwardly. This non-parallel relationship facilitates wedging engagement of the spreader with the stringers; however, said stringers may be parallel. A short, perpendicular arm or element **23** may extend from the medial portion of the spreader **21** and have a notch **24**, similar to the notches **22**, in its outer end for receiving the center stringer **14**. The inner end of the arm **23**, preferably, is secured to the spreader and may be notched in the same manner as its outer end. To permit folding or collapsing of the kite, the spreader and its arm are removable. Due to the confinement of the outer ends of the spreader **21** by the marginal stringers **11**, the perpendicular arm urges and holds the center stringer outwardly or laterally at an acute angle or inclination in a plane at a right angle to the plane of the marginal stringers. Since the upper end portion of the cover **12** is complementary to this angular relationship, it is stretched taut so as to provide a pair of complementary dihedral surfaces **25** which are substantially flat and which deflect the wind or air currents laterally of the kite, as shown by the arrows L in FIG. 10. When the spreader arm is used, the inclination of the dihedral surfaces is determined by the length of said arm and is subject to variation. An angle of inclination of 25° relative to the plane of the marginal stringers **11** is shown in FIG. 4, however, the angle thereof is not critical since it may vary approximately between 15° and 40°.

The lower or major portion of the cover **12** is of a width substantially greater than the distance between the marginal stringers **11** so as to be rather loose or full for flexing movement relative to said stringers as well as to the dihedral surfaces **25**. This fullness or looseness increases progressively downward from a point a short distance below the upper spreader **21** to the lower end of the cover whereby the center stringer **14** may extend at an angle to the plane of the marginal stringers with its lower end spaced from said plane. Also, the looseness or fullness of the lower portion of the cover **12** is sufficient to permit the formation of a longitudinal channel or recess **26** in the lower portion of each section **16** of said cover when the kite is flying, the channels being complementary and having the shape of a longitudinal segment of a cone due to the downwardly increasing width of said cover so as to deflect the wind or air currents downwardly of said kite, as shown by the arrows D in FIG. 10. Since the center stringer is attached to the cover and may be otherwise unrestrained below the upper spreader, the major portion of said stringer may be movable with the flexing of the lower portion of said cover and provide a central, longitudinal reinforcement for said lower portion. A bridle **27** is fastened to the center stringer **14** adjacent the upper spreader **21** and substantially mid-way between said spreader and the lower end of said stringer for connection with a cord or string **28**. Preferably, the lower margin of the cover is reinforced by a cord or string **29** in the usual manner.

A kite **30** of slightly modified construction is shown in FIGS. 4–9 and includes similar cylindrical marginal stringers **31**, cover **32**, stringer upper end portions **33**, center cylindrical stringer **34** and longitudinal halves or sections **36** of the cover and/or kite, the stringers being secured throughout their lengths to the cover. Instead of using the fastener **15**, a cap **35**, of plastics or other suitable material, may be provided for confining the upper extremities of the stringers. As shown by the numeral **37** in FIG. 9, the upper ends of the marginal stringers **31** are bent into parallel relation to the center stringer **34** for frictional engagement within the cap **35** which is ovoid in cross-section to dispose the stringer extremities in side-by-side relationship. A cylindrical crossbar of spreader **38**, of plastics or other material and similar to the crossbar **17**, extends between and connects the lower end portions of the marginal stringers in spaced relation to the lower end of the center stringer and has reduced end portions or axial pins **39** for projecting through cylindrical, transverse openings **40** in said marginal stringers and providing radial shoulders or enlargements **41** for bearing against the inner surfaces of the latter stringers (FIG. 8). The openings **40** are of slightly greater diameter than the pins **39** of the crossbar **38** and each pin has one or more radial projections **42** spaced from the adjacent shoulder **41** so as to engage the outer surface of one of the stringers **31** for restraining the lower end of the stringer. The projections **42** are of sufficient resiliency to permit outward passage of the pins through the openings and prevent relative inward movement except by force, whereby the crossbar is removable to permit collapsing or folding of the kite. One or more similar crossbars or spreaders **43**, having axial pins **44** of reduced diameter and short length, may be employed if the marginal stringers are

not sufficiently rigid and require reinforcement, the additional spreaders being of less length than the crossbar **38** so that said stringers converge upward slightly. Manifestly, the crossbars **38** and **43** could be of the same construction as the crossbar **17**.

A crossbar or spreader **45**, of circular cross-section and of a material similar to the material of the spreader **21**, extends between the marginal stringers **31** adjacent their junctures with the converging upper end portions **33** thereof. The spreader **45** is angular and has a pair of complementary, obtusely-extending arms or legs **46** which may terminate in alined, outer end portions **47** formed by offsetting or bending the ends of said spreader toward its medial apex (FIG. 6). Pins **48**, of reduced diameter and of short length, project axially from the end portions **47** of the spreader for engaging in complementary, transverse openings **49** in the marginal stringers. As shown by the numeral **50**, the apex of the spreader **45** is upset and has an arcuate recess or saddle for mating engagement with the center stringer **34** so as to urge and hold said stringer laterally or outwardly at an acute angle in a plane perpendicular to the plane of the stringers **31** and provide a pair of complementary dihedral surfaces **51** at the upper end portion of the cover **32** for deflecting the wind or air currents laterally of the kite **30**.

It is noted that the surfaces **51** are similar to the dihedral surfaces **25** of the kite **10**, but have less inclination due to the spreader **45** being of less effective angularity than the spreader **21** and its arm **23**. Although an angle of inclination of approximately 16° is shown in FIG. 6, this angle is subject to variation as has been explained. Since the cover **32** is substantially identical to the cover **12**, similar longitudinal channels or recesses **52** are formed in the lower or major portions of the longitudinal halves or sections **36** of said cover **32** for deflecting the wind or air currents downwardly of the kite. Due to the offsetting of the end portions **47** and the upsetting of the apex of the spreader, the cover is spaced from and does not engage said spreader so as to reduce wear of said cover. If desired, the end portions of the spreader **45** may be notched in the same manner as the spreader **21** for frictional engagement with marginal stringers. A bridle, similar to the bridle **28**, for connecting a cord or string (not shown) to the kite may be attached to the center stringer as shown at **52** in FIG. 5. Also, the lower margin of the cover may be reinforced by a cord or string **53**.

A novel device **55** for permitting automatic launching of the kite without manual holding of and/or running with said kite is shown in FIGS. 11–15 and may be formed of wire or other suitable material. The device includes an elongate, horizontal bar or rod **56** having depending end portions or legs **57** which may be inwardly disposed and pointed for engagement in the ground. Each end of the rod **56** may be bent upwardly, downwardly and upwardly to provide an upwardly opening loop **58** having upright, substantially parallel legs **59** and **60**. The loops **58** coact to provide slots or ways for removably confining the pins **39** of the crossbar **38** of the kite **30**, or the projecting ends of the crossbar **17** of the kite **10**, and the lower ends of said slots are enlarged by bowing or offsetting the lower ends of the legs **60** away from the legs **59**. An inwardly-directed, horizontal arm **62** connects the upper end of each loop leg **60** to an inclined arm or diagonal portion **63** which is joined to the upper end of each depending leg **57**. It is noted that the legs **57** provide convenient means for preventing movement of the launching device and that any suitable means may be utilized to anchor said device.

In use, the kite is laid on the ground or placed in prone position with its dihedral surfaces and longitudinal channels facing upwardly and with the ends of its bottom crossbar or spreader engaged in the lower ends of the slots formed by the legs **59** and **60** of the loops **58** of the device **55** (FIGS. 11–14), being engaged vertically with said device (FIG. 15). As shown, the kite extends downwind away from the upwind legs **57** and **60** so that its lower end overlies the horizontal rod **56**. By pulling on its string, the kite is pivoted upwardly, clockwise in FIGS. 11 and 12, to an upright or substantially vertical position (FIG. 15). From this position, the kite is adapted to ascend or rise if the force of the wind is sufficient for kite flying. The longitudinal channels of the kite deflect the wind downwardly so as to exert an upward thrust which causes said kite to climb or rise and the dihedral surfaces deflect the wind laterally to maintain said kite in a vertical position. During upward swinging movement, as well as in prone position, accidental disengagement of the kite from the launching device is prevented due to the fact that the horizontal arms **62** of said device overlie the lower ends of the marginal stringers of said kite (FIG. 13). The enlargement of the lower ends of the slots, such as by means of the offset lower ends **61** of the legs **60**, facilitates pivotal movement of the kite.

The vertical ascension of the kite continues so long as its string is let out or is sufficiently slack due to the dihedral surfaces at its upper end portion maintaining said kite in a vertical position as distinguished from the usual inclined attitude of kites. The dihedral surfaces are relatively fixed or restrained against any appreciable flexing and provide a positive lifting action of greater effect than the lifting action of the flexible lower portion of the kite. Therefore, the nose of the kite is constantly urged toward or seeks an absolute vertical position and the movement of said kite is stabilized. Although the lower portion of the kite flexes more or less constantly due to gusts of wind varying the tension on the lower end of the bridle, the longitudinal channels continually deflect the wind downward so as to exert an upward thrust on said kite. It is readily apparent that the crossbars, particularly the bottom crossbar, limit flexing of the lower portion of the kite; however, when the major portion of the center stringer is attached only to the cover, the flexing or collapsing of said lower portion is sufficient to permit said center stringer to move toward and away from the plane of the marginal stringers, as shown by the broken lines **34'** and **34''** in FIG. 7, and function as a fin which assists the stabilizing action of said kite.

This movement increases and decreases the curvature of the longitudinal channels, as shown by the broken lines **51'** and **51''**, whereby the flexible lower portion of the kite tends to vibrate so as to destroy or impair a large part of its lifting action and permit the greater lifting action of the dihedral surfaces to direct said kite vertically. The self-stabilizing action of the kite may be amplified by letting out the kite string whereby the lower portion of the center stringer is unrestrained and is free to move with the flexing of the lower portion of said kite, which lower portion tends to assume the contour shown by the broken lines **34'** and **51'**. When the kite string is held against climbing movement, the center stringer is restrained against movement relative to the marginal stringers and the lower portion of the kite tends to assume the contour shown by the broken lines **34''** and **51''** in FIG. 7 whereby said lower portion is relatively taut. Contrary to conventional kites, however, moving of the kite string upwardly relative to the bridle reduces the stability of the kite by permitting greater relative movement of the center stringer and flexing of the lower portion of said kite thereby facilitating stunting, turning and looping of said kite. Stability is increased by relative downward movement of the kite string which restrains the center stringer to a greater extent and permits less flexing of the lower portion of the kite.

It is pointed out that the structure of the kite is subject to variation. For example, the upper end of the marginal stringers could terminate at the top spreader and a cord or string (not shown) instead of the converging end por-

tions could extend from said upper ends to or around the upper extremity of the center string or an arcuate or bowed, one-piece reinforcement (not shown) could connect the margins of the upper end portion of the kite. It is believed unnecessary to illustrate these conventional modifications. If desired, the center stringer may be relatively immovable throughout its length by being attached to the bottom crossbar as well as the other crossbars or spreaders. The bottom crossbar **38** is shown in FIG. 16 as having a perpendicular arm or element **64**, similar to the arm **23** of the top spreader **21** but of greater length, connecting its medial portion to the lower end of the center stringer **34**. Also, one or more of the crossbars **43** could be of this modified construction so as to reinforce and prevent movement of the center stringer relative to marginal stringers. Even though the center stringer is relatively immovable, the lower portion of the cover **32** is sufficiently full or loose to provide the longitudinal channels **51** and permit flexing of said lower portion in a manner similar to but of less amplification than when the major portion of said stringer is unrestrained. If desirable or necessary, the fullness or looseness of the cover may be increased to at least partially offset the immovability of the center stringer. This modification renders the kite slightly less stable. It is most essential that the longitudinal halves or sections **16** or **36** of the kite be mirror images or as identical as possible so that said kite is aerodynamically balanced and capable of substantially absolute vertical ascension. Manifestly, the cover of the kite may be decorated so as to have the appearance of a rocket or missile, it being contemplated that a dummy nose cone as well as fire-like tail streamers may be provided. The narrow, oblong shape of the kite and its vertical ascension and launching characteristics accentuate the resemblance to a rocket or missile.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What we claim and desire to secure by Letters Patent is:

**1.** A kite including an oblong frame having marginal reinforcing means coextensive with its longitudinal margins and central reinforcing means coextensive with its longitudinal center, the marginal reinforcing means being in a common plane and having upper end portions converging toward and connected to the upper end portion of the central reinforcing means, rigid bottom means extending transversely between and connecting the lower ends of said marginal means in spaced relationship, rigid top means extending transversely between and spacing apart the upper end portions of the central and marginal means, said central means being adapted to extend at an angle in a plane perpendicular to the plane of said marginal means, and a membrane secured to and supported by said central and marginal means and having an upper portion conforming to the angular relationship of the upper end portions of said central and marginal means so as to provide a pair of dihedral surfaces for deflecting air currents laterally of the kite and directing said kite vertically, the lower portion of the membrane being of a greater width than the frame and providing transverse fullness to permit flexing of said lower portion for deflecting air currents downwardly of the kite and exerting an upward thrust on said kite, the rigid top means being on the downwind side of said central means and membrane whereby the dihedral surfaces converge upwind of the kite.

**2.** A kite as set forth in claim **1** wherein the bottom rigid transverse means is connected to the lower end of the longitudinal central reinforcing means in spaced relation to the plane of the longitudinal marginal reinforcing means whereby said central means is relatively immovable.

**3.** A kite as set forth in claim **1** wherein the major portion of the longitudinal central reinforcing means is attached only to the membrane so as to be free to undergo flexing movement with the lower portion of said membrane.

**4.** A kite as set forth in claim **1** wherein the fullness of the lower portion of the membrane is sufficient to provide a longitudinal air deflection channel of substantially arcuate cross-section between the central and each marginal longitudinal reinforcing means.

**5.** A kite as set forth in claim **4** wherein the width of the lower portion of the membrane increases progressively downward whereby the longitudinal channels of said membrane increase in size progressively downward.

**6.** A kite as set forth in claim **1** wherein the longitudinal marginal reinforcing means includes substantially rigid members extending between the bottom and top rigid transverse means so as to prevent flexing of the longitudinal margins of the kite.

**7.** A kite as set forth in claim **1** wherein the central longitudinal reinforcing means includes a substantially rigid member.

**8.** A kite as set forth in claim **1** wherein the membrane has its longiutdinal center secured to the central longitudinal reinforcing means and the width of the lower portion of said membrane increases downward progressively to provide a longitudinal air deflection channel between said central means and each longitudinal marginal reinforcing means, the channels being complementary and having the shape of a longitudinal conical section.

**9.** A kite as set forth in claim **1** including intermediate rigid means extending transversely between and spacing apart the intermediate portions of the longitudinal marginal reinforcing means.

**10.** A kite as set forth in claim **1** wherein the rigid transverse means are removable to permit longitudinal folding of the kite.

**11.** In combination with a kite of the character described having marginal reinforcing means at its longitudinal margins and rigid means extending transversely of its bottom with the lower ends of its longitudinal marginal reinforcing means projecting downwardly beyond its bottom rigid transverse means, a launching device including means forming an upwardly facing opening for receiving said bottom transverse means, and means overlying the projecting ends of said longitudinal marginal means when said kite is in a substantially horizontal position whereby said kite is confined until it is pivoted to an upright position.

**12.** In combination with a kite having longitudinal marginal frame members and means projecting laterally from the frame members adjacent and above their lower ends, a launching device including means forming a pair of spaced upwardly facing openings for receiving the lateral means, and means adjacent the openings for overlying the lower ends of said frame members when said kite is in a substantially horizontal position so as to prevent disengagement of said lateral means from said openings whereby said kite is confined until it is pivoted to an upright posiiton.

**13.** The combination set forth in claim **12** wherein the launching device is formed of wire and has a pair of parallel loops forming the pair of openings in parallel relationship for receiving the laterally projecting means of the kite.

**14.** A kite including an oblong relatively narrow membrane having a rigid upper end portion, a trio of stringers supporting the longitudinal margins and the longitudinal center of the membrane, the marginal stringers being in a common plane and the center stringer being disposed medially thereof so as to divide the membrane into a pair of complementary longitudinal sections, spreaders extending transversely between and maintaining said marginal stringers in spaced relationship, the upper end portions of said marginal stringers converging toward and connected to the upper end portion of said center stringer

and coacting therewith to support the upper end portion of said membrane, one of the spreaders having means for supporting said center stringer in inclined relation to and in a plane at a right angle to the plane of said marginal stringers whereby said membrane upper end portion is angular in cross-section and has a pair of dihedral surfaces for deflecting air currents laterally of the kite and directing said kite vertically, the lower portion of each longitudinal section of said membrane being of a width greater than the spacing of each marginal stringer from said inclined center stringer and providing fullness to permit flexing of said lower portions of the membrane sections for deflecting air currents downwardly of the kite and exerting an upward thrust on said kite, said spreaders being on the downwind side of said membrane and center stringer whereby the dihedral services converge upwind of the kite.

**15.** A kite as set forth in claim **14** wherein the fullness of the lower portion of each longitudinal section of the membrane is sufficient to provide a longitudinal channel of substantially arcuate cross-section therein.

**16.** A kite as set forth in claim **15** wherein the width of the lower portion of each longitudinal section of the membrane increases progressively downward whereby the longitudinal channels increase in size progressively downward.

**17.** A kite as set forth in claim **14** wherein the lower portion of the longitudinal center stringer is attached only to the membrane so as to be free to undergo flexing movement with the lower portion of said membrane.

**18.** A kite as set forth in claim **14** wherein one of the spreaders is at the lower end portion of the kite and has means for holding the center stringer in spaced relation to the common plane of the marginal stringers whereby said center stringer is relatively immovable.

**19.** A kite as set forth in claim **1** wherein the rigid top means includes means for supporting the central reinforcing means at an angle in a plane perpendicular to the plane of the marginal reinforcing means.

**20.** A kite including a membrane having lateral margins converging upwardly in an apex, a pair of frame members substantially coextensive with and attached to the lateral margins of the membrane so as to have converging upper ends at the apex of said membrane, an elongate upright member attached to at least the major portion of the vertical center of said membrane medially of the frame members so as to divide said membrane into a pair of complementary vertical sections, and spreader means extending transversely between and connecting said frame members in spaced relationship, the spreader means being of a length less than the width of said membrane at the point of connection of said spreader means to said frame members whereby said membrane has transverse fullness to permit flexing thereof relative to said frame members, at least the major portion of the center member being movable with said membrane and adapted to have a kite string connected to at least its upper portion whereby, when the kite is flown, said center member extends in inclined relation to and in a plane at a right angle to the plane of said frame members and the upper portion of said membrane is angular in cross-section so as to provide a pair of dihedral surfaces for deflecting air current laterally of the kite and directing said kite vertically, said spreader means being on the downwind side of said membrane and center member whereby the dihedral surfaces converge upwind of the kite.

**21.** A kite as set forth in claim **20** wherein the elongate center member is substantially coextensive with the membrane and has connection with the upper ends of the frame members.



**22.** A kite including a frame having a pair of members at its longitudinal margins, the frame members being in a common plane and having upper ends portions converging toward each other in an apex, at least one spreader extending transversely between the intermediate portions of said frame members and connecting said members in spaced relationship, a membrane secured to and supported by said frame members and of a width greater than the frame so as to have transverse fullness for flexing relative thereto, and an elongate center member attached to and extending longitudinally of at least the major portion of the membrane medially of said frame members so as to divide said membrane into a pair of complementary longitudinal sections, at least the major portion of the center member being movable with said membrane and adapted to have a kite string connected to at least its upper portion whereby, when the kite is flown, and said center member extends in inclined relation to and in a plane at a right angle to the plane of said frame members and the upper portion of said membrane is angular in cross-section so as to provide a pair of dihedral surfaces for deflecting air currents laterally of the kite and directing said kite vertically, the spreader being on the downwind side of membrane and center member whereby the dihedral surfaces converge upwind of the kite.

**23.** A kite as set forth in claim **22** wherein the elongate center member is substantially coextensive with the membrane and has connection with the upper ends of the frame members.

**24.** A kite including an oblong frame having marginal reinforcing means coextensive with its longitudinal margins and central reinforcing means coextensive with its longitudinal center, the marginal reinforcing means being in a common plane and having upper end portions converging toward and connected to the upper end portion of the central reinforcing means, rigid bottom means extending transversely between and connecting the lower ends of said marginal means in spaced relationship, rigid top means extending transversely between and spacing apart the upper end portions of the central and marginal means, said central means being adapted to extend at an angle in a plane perpendicular to the plane of said marginal means, a membrane secured to and supported by said central and marginal means and having an upper portion conforming to the angle relationship of the upper end portions of said central and marginal means so as to provide a pair of dihedral surfaces for deflecting air currents laterally of the kite and directing said kite vertically, the lower portion of the membrane being of greater width than the frame and providing transverse fullness to permit flexing of said lower portion for deflecting air currents downwardly of the kite and exerting an upward thrust on said kite, and means extending laterally of the lower ends of said marginal reinforcing means in combination with a launching device having means for receiving and confining the lateral means when the kite is in a substantially horizontal position and permitting pivoting of said kite to an upright position and disengagement of said lateral means upon vertical lifting of the upright kite.


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