Aug. 15, 1967 A. D. NEAL 3,335,985

INFLATED KITE

Filed July 30, 1965

Fig. 4

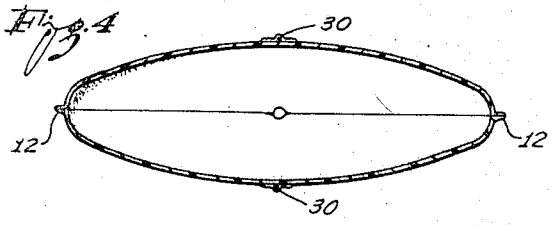


Fig. 1

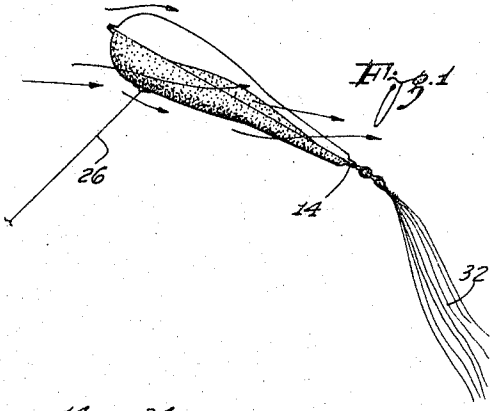


Fig. 5

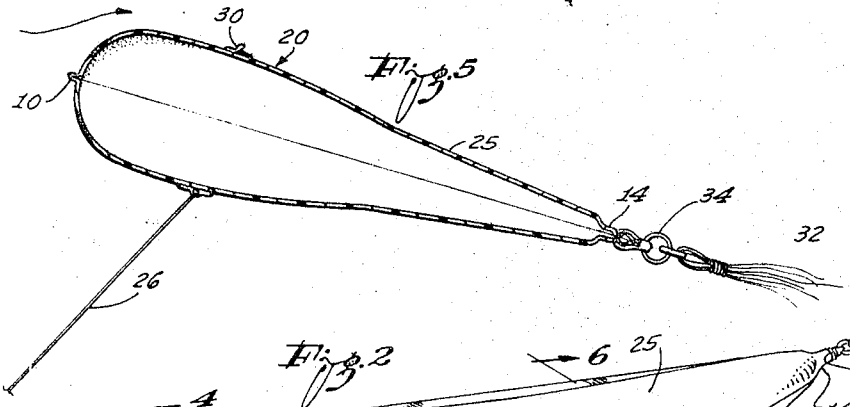


Fig. 2

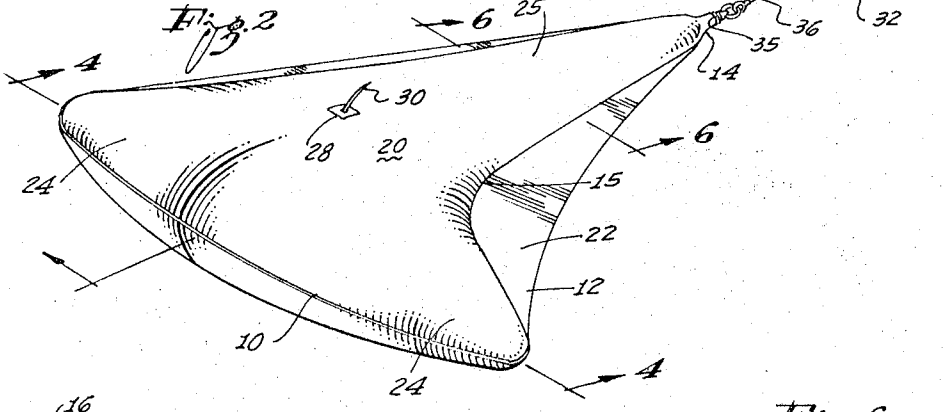


Fig. 3

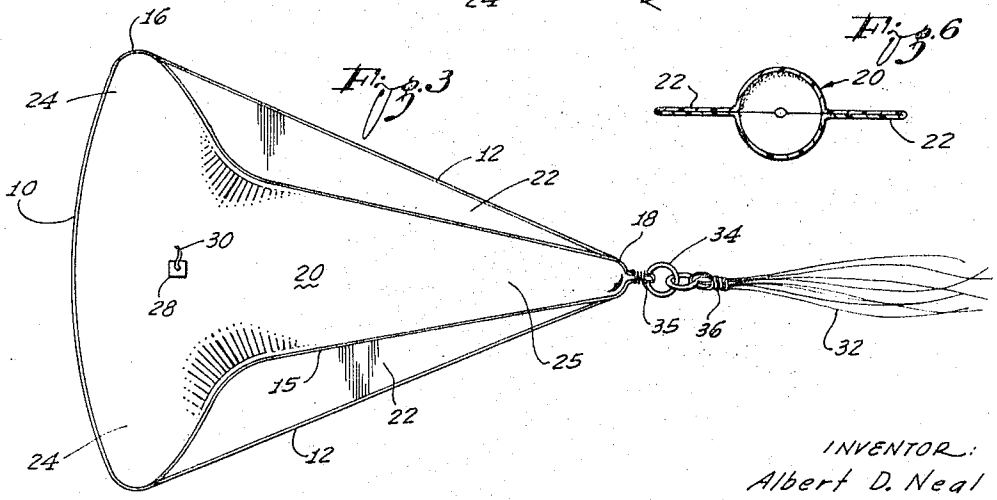


Fig. 6

INVENTOR:
Albert D. Neal

By Smyth, Roston & Pavitt
Attorneys

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INFLATED KITE

Albert D. Neal, 5509 Ocean Front Walk, Playa del Rey, Calif. 90291

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This invention relates to a kite and, more particularly, relates to an inflated kite capable of serving multiple purposes.

As a toy or a recreational device, the kite is capable of flight in even a mild breeze and may be attractively decorated for the pleasure of youngsters. In this respect a feature of the invention is that the kite is reversible in the sense that either face of the kite may be presented to the breeze. The two faces of the kite may be of two different colors so that, in effect, the color of the kite may be changed simply by shifting the string connection from one face of the kite to the other face.

The invention affords several advantages as a device for use in emergencies at sea. One advantage is that the kite may be made of thin flexible plastic so that the kite in deflated state may be rolled into an exceedingly compact light-weight package. Another advantage is that if necessary, the inflated kite may serve as a lifesaver to keep a person afloat. Still another advantage of special importance is that the kite may be both radar-reflective and light-reflective to facilitate a search at sea.

It has been found by actual test that an inflated kite is inefficient if it comprises multiple inflated compartments because the connections between the compartments function as hinges to permit the compartments to swing relative to each other to aerodynamically unfavorable angles relative to each other. In the same manner if a kite is made of a single envelope to buckle intentionally, the buckling may permit the envelope to assume inadventent-up an unfavorable configuration.

The invention is based on the further discovery of the cause of buckling of a single envelope. It has been found that if the tethering string is connected to the single envelope at two widely spaced points, the envelope will tend to buckle in one direction midway between the two points and if the string is connected only to a central region of the envelope the envelope will tend to buckle in the opposite direction but in either case buckling may be prevented by making the envelope of ample cross section in the central region where buckling tends to occur. A further finding is that buckling tends to occur in a region where there is an abrupt change in the cross section of the single envelope and therefore there should be a smooth transitional at any change in the cross section of the envelope.

Finally the invention is based on the discovery that a single non-buckling envelope with two opposite side alcoves making the envelope of a generally T-shaped configuration is inherently aerodynamically efficient and especially so if both of the two lateral arms taper towards their outer ends. The upper end or edge of the envelope must be of smoothly curved cross section to avoid any tendency to buckle and the transition from the two arms of the configuration must be smooth and relatively gradual.

A further discovery is that stability is increased if the kite is provided with flaps or webs on its opposite sides with each flap stretching from the region of the outer end of the corresponding lateral arm of the envelope to the region of the lower end of the envelope. The resultant kite is so stable that it may be flown at the end of a string that is connected solely to the central region of the envelope where the axis of the two arms intersects the longitudinal axis of the envelope.

An important feature of the invention is that the kite may be produced at surprisingly low cost by simply bonding together two substantially coextensive thermoplastic flexible sheets of the general configuration of a triangle, one leg of the triangle being the top edge of the kite. The two sheets are heat bonded together around the periphery of the triangle and in addition the two sheets are bonded together along inwardly bowed lines on each side of the triangle, each bowed line extending from the region of the outer end of the corresponding arm of the envelope towards the region of the lower end of the envelope. Only the central region defined by the two inwardly bowed bond lines is inflated to form the single T-shaped envelope, the two inwardly bowed lines together with the outer edges of the two sheets defining the two stabilizing side flaps.

In the preferred practice of the invention the upper edge of the triangular configuration of the two sheets is convex so that the upper edge of the inflated envelope is of convex cross section longitudinally of the edge; when the kite is inflated this upper edge of the kite is also of convex cross section laterally of the edge. The outward bowing of the upper edge and the inward curvature of the two inwardly bowed bond lines result in a tapered kite configuration, each arm of the T-shaped configuration tapering in cross section towards its outer end and the longitudinal portion of the T-shaped configuration tapering towards the lower end of the envelope.

It can be seen in FIG. 3 that the outline of the kite as viewed in front elevation is an isosceles triangle with a convex base uppermost and the outline of the inflated envelope **20** is a second isosceles triangle with a convex base uppermost and coinciding with the base of the first triangle. The second triangle differs from the first in that the two sides of the triangle are curved inwardly relatively to the sides of the first triangle. Each of the two side flaps **22** of the kite is defined by two corresponding sides of the first and second triangles.

The resultant kite is inherently stable because it presents a dihedral to the wind. The dihedral is created in part by the tapering cross section of the two arms of the T-shaped configuration, in part by the inherent bulbous character of the inflated envelope, and in further part by the two stabilizing flaps as they flex rearward in response to wind pressure.

The features and advantages of the invention may be understood from the following detailed description and the accompanying drawing.

In the drawing, which is to be regarded as merely illustrative:

FIG. 1 is a side elevation of the kite in flight;

FIG. 2 is a perspective view from above of the kite in flight;

FIG. 3 is a plan view of the inflated kite;

FIG. 4 is a transverse section along the line **4—4** of FIG. 2;

FIG. 5 is a longitudinal section of the envelope taken as indicated by the line **5—5** of FIG. 2; and

FIG. 6 is a transverse cross section taken along the line **6—6** of FIG. 2.

The construction of the kite may best be understood by first describing the method of fabrication. FIG. 3 shows how two sheets of thin thermoplastic material of identical configuration may be positioned face to face as the first step of the fabrication of the kite. It can be seen that the two sheets are of the general configuration of a of a triangle, one side of the triangle being the upper edge of the kite. This upper edge of the two sheets, which is designated **10** in FIG. 3, is preferably concave or bowed outward and the other two legs of the triangle are preferably straight legs forming two converging straight side edges **12** of the kite. Preferably, but not necessarily, the

configuration of the two plastic sheets also includes a tab extension **14** at the lower vertex of the triangle.

The next step in the fabrication of the kite is to bond the two sheets together around the entire periphery of the two sheets except across the end of the tab extension **14**. For this purpose the two sheets may be heat bonded by applying heat and pressure along the desired bond lines. It is to be noted that the resultant heat-bonded seam extends along the outwardly curved upper edge **10** and along the two straight side edges **12** and additionally along the two sides of the tab extension **14**. The bonding operation may be carried out in a flat press, or may be carried out by means of cooperating rolls, or may be carried out by hand by simply moving a heated element under pressure along the desired line of bonding.

The next step is to bond the two sheets together in the same manner along two lines **15** that are bowed inwardly from the opposite sides of the assembly, each of the two lines merging with the peripheral bond line at a point **16** at the upper end of the triangle and at a second point **18** near the lower vertex of the triangle.

The result of the fabrication procedure is a kite comprising a single envelope, generally designated **20**, flanked by two flexible flaps, each designated by the numeral **22**. Obviously, the peripheral edges of the two sheets need not be bonded together between the two points **16** and **18** on each side of the kite, but such bonding is preferred for mutual reinforcement of the two sheets. It can be seen in FIG. 3 that the envelope **20** is of generally T-shaped configuration with opposite lateral arms **24** and a longitudinal stem **25**. It also can be seen that the two arms **24** taper in cross section towards the lower end of the envelope. As may be seen in FIG. 5 the upper edge of the kite is blunt, but smoothly curved. It may be further seen in FIGS. 2 and 3 that the upper edge **10** of the kite is also concave longitudinally of the edge.

It can be seen in FIG. 1 that the transverse cross section of the kite in the region of the two alcoves or arms **24** is generally oval tapering in thickness in opposite directions from a central region of maximum thickness. It can be seen in FIG. 5 that the longitudinal section of the kite tapers in both directions from a region of maximum thickness that is substantially closer to the upper end of the kite than to the lower end. It can be further seen in FIGS. 3 and 5 that the kite has a bulbous nose which extends across the full width of the upper end of the kite, the upper end of the kite being convex as viewed both in front elevation and in side elevation.

It may be noted by comparing the various views that the point of maximum thickness of the single envelope is in the region of the intersection of the longitudinal axis of the envelope with the transverse axis of the two arms **24**. In the drawing a single string **26** is connected to the envelope in this region. Since the kite flies in a stable manner on the end of a single string, it is obvious that the center of pressure of the kite in flight is at the string connection. In the preferred practice of the invention, each face of the envelope carries a small patch of cloth **28** bonded thereto for the purpose of attaching a string to the kite. Each cloth patch **28** may carry a short length of string **30** which may be tied to a second string of any desired length. If desired a single string may be employed which branches to various points of connection with the envelope but preferably if multiple points of connection are employed the multiple points are all in the same region as the intersection of the two axes of the envelope.

The envelope may be inflated by inserting a tube temporarily into the tab **14** and then blowing into the tube while the tab material is held snugly around the tube. After the envelope is inflated that tab **14** may be folded onto itself or twisted and then secured by an encircling rubber band.

The kite will fly without a tail but flies with greater efficiency and to greater height with a tail. A suitable tail **32** may comprise four ribbons of the same plastic material, each ribbon being approximately ¾ to one inch in width and approximately ten to twelve feet in length. In the preferred practice of the invention two lengths of ribbon twenty to twenty-four feet long are folded to make the four ribbons.

The tail **32** may be conveniently attached to the envelope **20** by means of a pair of small interlinked plastic rings **34**. When the kite is inflated the tab **14** is folded to form a loop in engagement with one of the two rings **34** and then a rubber band **35** is placed around the folded tab so that the rubber band not only seals the tab against escape of air but also serves as means for mechanically connecting one of the rings **34** to the tab. The two folded ribbons of the plastic material may then be doubled back through the other of the two interlinked rings **34** and secured thereto by a second rubber band **36**. It is to be understood that while the tab **14** provides an inlet port for inflating the envelope, other provisions for inflation may be made in other embodiments of the invention.

If the kite is manufactured as a toy or recreational device it may be attractively decorated in any suitable manner. Preferably two sheets of plastic material of two different colors are used, for example red and green, so that the two faces of the kite are of contrasting colors. The apparent color of the kite, that is the color of the flying kite as viewed from the ground, may be changed by simply changing the string connection from one face of the kite to the other.

If the kite is designed for emergency use at sea, a sheet material will be selected that is radar reflective, for example a sheet material having a metal coating. Preferably the sheet material selected for this purpose has a bright metal coating to be not only radar reflective but also light reflective so that the kite may be conspicuous by reflected light.

The fact that the kite is aerodynamically stable is demonstrated by the stable manner in which the kite flies with only a single connection to the kite string. The stability results from the dihedral configuration.

My description in specific detail of the selected embodiment of the invention will suggest various changes, substitutions and other departures from my disclosure within the spirit and scope of the appended claims.

I claim:

1. A kite comprising:

a single elongated inflated envelope of flexible sheet material having two opposite side alcoves at the upper end of the kite,

said two alcoves tapering towards the sides of the kite as the kite is viewed both in front elevation and in end elevation,

said envelope tapering from the region of the alcoves towards the lower end of the kite as the kite is viewed both in front elevation and in side elevation,

the cross-sectional configuration of the envelope transversely of the kite in the region of the two alcoves being generally oval with maximum thickness centrally of the cross section,

the upper end of the kite being formed by a bulbous nose of the envelope extending across the full width of the kite,

said upper end of the kite being convex as the kite is viewed in front elevation; and

flexible webs on each side of the envelope for stabilizing effect when the kite is in flight, each web extending from the corresponding alcove of the envelope downward to the lower end portion of the envelope.

2. A kite as set forth in claim **1** in which each of said webs is defined in part by a curved line at the juncture of said envelope and one of its alcoves.

3. A kite as set forth in claim **1** in which said flexible webs on the two sides of the kite are the sole stabilizing webs of the kite.

4. A kite as set forth in claim **1** in which said envelope is symmetrical both relative to a longitudinal plane in

the maximum width dimension of the envelope and in a longitudinal plane perpendicular to the first mentioned plane.

5. A kite as set forth in claim 1 in which the taper of the envelope towards the lower end of the kite and the taper of the two alcoves are continuous, the degree of taper being sufficient to make the envelope rigid when inflated.

6. A kite of sheet material of the outline in front elevation of a first isosceles triangle with its base end uppermost, said kite having a single inflated envelope of the general configuration in front elevation of a second isosceles triangle with its base end uppermost, said second triangle having inwardly curved opposite sides; and

two stabilizing webs on opposite sides of the kite, each of the webs being defined by a side of the first triangle and a corresponding inwardly curved side of the second triangle.

7. A kite as set forth in claim 6 in which the uppermost bases of the two triangles coincide.

8. A kite as set forth in claim 7 in which the uppermost bases of the triangles are convex.

9. A kite as set forth in claim 6 in which the envelope is of maximum cross section in a region substantially

closer to the upper end of the kite than to the lower end; and in which the envelope tapers from said region in both longitudinal directions and both lateral directions.

10. A kite as set forth in claim 6 which in flight has a center of pressure on its longitudinal axis substantially closer to the upper end of the kite than to the lower end and in which the envelope is rigid to maintain its shape when the kite is flown with a single string connected to the envelope at said center of pressure.

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MILTON BUCHLER, *Primary Examiner.*

P. E. SAUBERER, *Assistant Examiner.*