May 16, 1933. W. M. GRAY 1,909,760

SAFETY DEVICE FOR AERIAL SIGNS

Filed Dec. 27, 1932

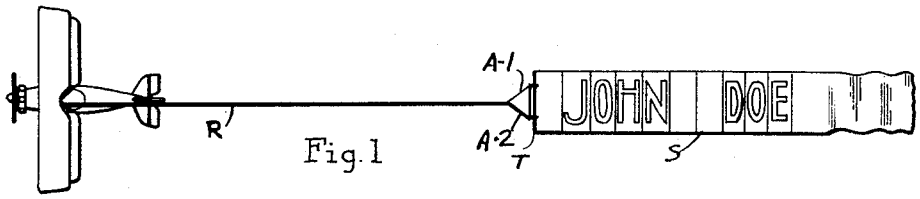


Fig. 1

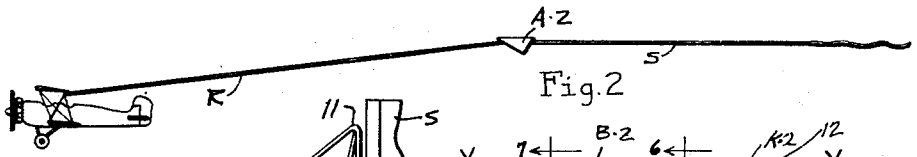


Fig. 2

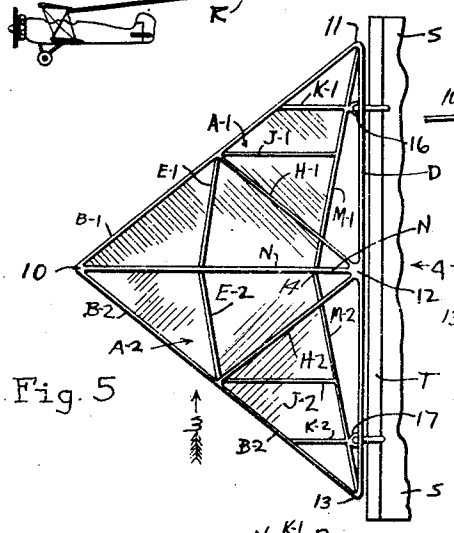


Fig. 5

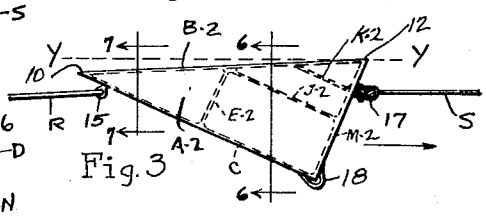


Fig. 3

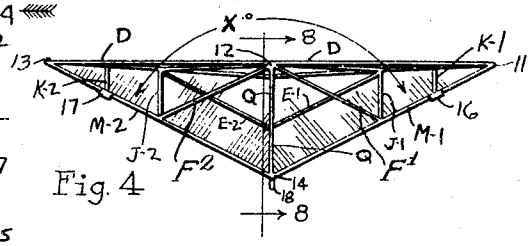


Fig. 4

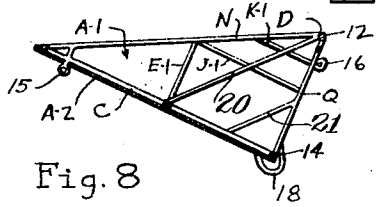


Fig. 8

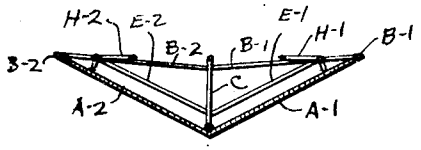


Fig. 6

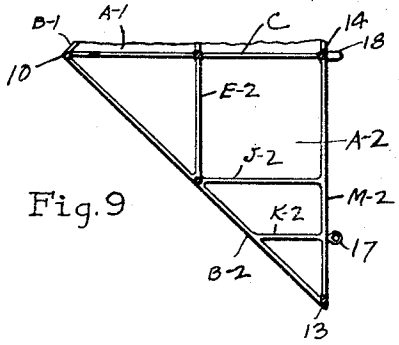


Fig. 9



Fig. 7

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UNITED STATES PATENT OFFICE

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SAFETY DEVICE FOR AERIAL SIGNS

Application filed December 27, 1932. Serial No. 648,893.

This invention belongs to the class of kites or structures which are maintained aloft in the air by relative movement between the device and the air, as, for instance, being towed along, or tethered while wind blows against it in a direction opposite to the pull of the tethering means; which may be adapted to carry a long flexible fabric spread behind it, and to maintain steady movement with such load. It is especially adapted for towing by aircraft, such as airplanes or dirigible balloons.

Among the objects of this invention are:

To provide a kite or structure which is adapted to be towed and which is capable of supporting and moving an appreciable load, particularly in the form of a comparatively long fabric attached to the rear of the kite; which, under the towing force and the air resistance of the fabric, will ride smoothly, steadily and evenly without dipping or jumping or substantial horizontal deviation from a straight line between the towing means and the attached fabric; which will maintain its steadiness even at high relative velocities between it and the air; which is capable of sustaining and maintaining untwisted a long flexible sign or advertisement so that it is readable, and which may be used for lifting and carrying a variety of different kinds of loads.

Other objects are, to provide an air-supported device having a single forward towing point for reception of a tension member and two spatially positioned supporting points in the rear for carrying a fabric sign or other load attached thereto; to provide a construction having lightness and strength and with said force application points so positioned that the forces are in balance when the kite and its load are aloft and being towed through the air; which can be produced easily, simply and at a low cost.

Other objects will appear as this description proceeds.

With the foregoing and other objects in view, the invention consists in the novel and useful formation, construction, interrelation and combination of parts, members and features, as well as mode and methods of use thereof and steps and performances followed and provided for, as hereinafter described, shown in the drawings and pointed out in claims.

In the drawing:

Fig. 1 is a plan view illustrative of an application of this kite, including a towing airplane and a supported sign connected to the kite, drawn to a very small scale.

Fig. 2 is a side elevation of same drawn to the same scale.

Fig. 3 shows a vertical elevation of the kite with towing member and load member drawn to a larger scale.

All succeeding figures are drawn to this same scale.

Fig. 4 is an end elevation taken at the rear or trailer end of the kite.

Fig. 5 is a plan view of the kite showing a fragment of an attached fabric or sign. The arrows marked 3 and 4 respectively indicate the direction of view for the showings made in Figs. 3 and 4 respectively.

Fig. 6 is a transverse sectional elevation of the kite on section line 6—6 of Fig. 3.

Fig. 7 is a transverse sectional elevation of the kite on section line 7—7 of Fig. 3.

Fig. 8 is a longitudinal mid-sectional elevation on line 8—8 of Fig. 3 with added braces.

Fig. 9 is an under view of one half of the frame such as would be made by the trace of a plane parallel to member B—2 and also to member M—2 indicative of the general relation of the bracing members.

It is to be observed that the frame work shown is made of light tubing disposed in the manner depicted, but this is only one arrangement of parts and character of material which may be used and by no means the form or material which may be employed for the frame work structure and braces under certain conditions, although the shape of the air surfaces is to be substantially as depicted in the figures.

It is clear from the figures that the kite is made up of two similar triangular surfaces, which two surfaces are joined together along one similar side of each triangle. As shown, the triangles are right-angle trian-

gles, which form is preferred. The two surfaces are fastened together with an angle between them as X in Fig. 4 which angle is constant throughout the horizontal length of the kite and in excess of 90 degrees. The angles which the two surfaces make with a vertical plane through the apex of the angle formed by their junction are identical, as indicated more particularly in Figs. 4, 6 and 7. From this description it is obvious that the kite has the general form of a pair of angularly related surfaces which taper uniformly from the maximum width in the rear to a point at the forward end. In the figures it is seen that the kite is symmetrical about its middle line. Hence, all the similar parts are given the same indicating letter and the right and left sides are distinguished by the suffix 1 for right and 2 for the left side as shown. The so-called "back-bone" element C, extends longitudinally from front to rear following the vertex of the angle formed by the junction of the two surfaces as shown. Diagonals B—1 and B—2 extend from the vertex forward of the kite, rearwardly and outwardly and join straight transverse member D, or as indicated in Fig. 5 these two diagonals are integral with transverse member D, the three making a plane triangle which forms the frame for the upper horizontal surfaces. Bars M—1, M—2 (Fig. 8) extend downwardly from the rear of the horizontal triangle to the back-bone bar C as indicated. These form the complete outline of the kite and when the surfaces A—1, A—2, of a preferred material or fabric are fastened on the sides, the frame of the structure is complete. The other members, E—1, E—2, F—1, F—2, H—1, H—2, J—1, J—2, K—1, K—2, 20 and 21 are all braces which may be disposed as shown or in any other preferred manner. Upper bar N extends from vertex 10 to junction point 12 in the middle of upper transverse bar D. The preferred form of frame is that shown in Figs. 3 and 5 in which members F—1, F—2, 20 and 21 are not included. These members depicted in Figs. 4 and 8 respectively are simply illustrative of variants possible to add to the fundamental form.

In general the kite presents a triangular form from a longitudinal or transverse point of view. The plan is an isosceles triangle with an apex at the front, the two equal sides each extending rearwardly the full length of the kite and spreading outwardly from front to rear. Either side view shows a triangle which is a right triangle or one nearly approaching this form. The hypothenuse or longest side extends in a substantially horizontal plane from front to rear, the acute angle of this triangle being at the front of the kite as shown. A rear view of the kite shows an isosceles triangle whereof the unequal leg is longer than the equal ones, the two equal sides converging at the bottom where the back-bone C joins the lower vertex of the right triangle at 14.

While the upper edge of the kite is mentioned as horizontal it is not actually so when in use but the rear flies somewhat higher than the forward end as indicated by divergence of the upper edge from the horizontal dotted line Y—Y in Fig. 3. Back-bone member C which slopes upward from rear to front is joined at 10 to forward apex between members B—1 and B—2. 15 indicates the forward anchor eye for the tow rope which is attached to back-bone member C at a point near the forward end of the structure and therefore near the upper edge thereof as shown. 16 and 17 are right-hand and left-hand anchor eyes respectively for holding the drag members of the fabric or load, these being attached at the rear equidistant from the middle and placed for equalizing the load symmetrically, and also, spreading a fabric. One of these two load supporting eyes is attached to member M—1 the other to member M—2, both being located at an elevation somewhat below the upper edge of the structure. This condition is indicated in Figs. 3 and 5.

Member 18 is simply a rounded portion or excrescence attached to member C at the rear end and bottom thereof which serves as a landing or skid shoe and useful only when the kite is lowered to the ground.

As is obvious the elevation of the kite is usually higher than that of the towing means when the relative velocity between the kite and the air is sufficient to enable the kite to lift and carry its load. The general application of this device is as indicated in Figs. 1 and 2. The airplane tows the kite represented by surfaces A—1, A—2, by rope R, while the fabric S attached to the rear of the kite trails out behind this support, the spread and weight of the fabric and the size of the kite together with the related positions of all applied surfaces producing substantially level travel through the air without twisting the fabric, so that a sign or device depicted thereon is clear to beholders at a lower elevation. From all of which the structure and its method of operation are clear.

The angular relationship of the different triangularly-formed portions are most important, particularly the angle X of spread between the surfaces. The length over all is related to the weight of the load and, for a display fabric, is related to the spread and length of the latter as well as its weight. Also the specific and relative locations of the tow line and load support eyes are almost critical and slight deviations from their proper positions would cause the kite to dip, swerve and become unmanageable and useless for the purpose designed.

If one factor or dimension is changed it may be in some measure compensated by changing some other related factor, but, in general, the preferred angle X between the two surfaces converging at rib C, must be between 100 and 140 degrees. For one specific case the angle of 114 degrees was found most suitable. Also the forward angle between the two edges of the surfaces, that is between either member B and member C, was determined to be 22 degrees which fixed the upper angle at the rear of the surfaces as 68 degrees. These values are simply indicative of general preferred angular relations of the three sides of each supporting surface and between the planes of the two surfaces. Obviously certain departures are both permissible and suitable for different kinds of loads and the weight thereof. The lifting surfaces need not be strictly right triangles but the lower rear angle may depart from the value of 90 degrees by compensatory shifting of other angles or the positions of the towing or the load carrying eyes.

In this specification where the word "towing", and the phrase "drawing along" are employed they are intended to mean the application of a force, longitudinal of the kite or glider, which may simply hold it against the rearward thrust of moving air without changing its location or may move it continually through the air travelling continuously, or in other words "towing" produces relative motion between the kite and the ambient air.

Having described my invention in connection with illustrative embodiments, forms, proportions, and arrangement of parts, it will be understood that many variants thereof are possible to those skilled in the art, and my invention, in its broader aspects, is not limited to the specific construction herein described and shown, as changes in the sizes, proportions, configurations, arrangements, assemblage, interaction, juxtaposition and mechanical relations, as well as additions, omissions, substitutions, combinations and alterations of forms, parts, members and features, may be made without departing from the broad spirit of this invention.

Having thus disclosed my invention, I claim and desire to show by Letters Patent:

1. In a load-carrying air-supported structure, the combination of a pair of similar lifting surfaces each being triangular in form and having an acute angle, said surfaces being joined along one similar side of each extending from said acute angle, the planes whereof are in predetermined angular relationship, said acute angles forming the forward end of the structure, there being a towing point located in the vertex of said angle between said two surfaces, and a pair of spatially positioned load-holding points in the rear of said structure, said two latter points being symmetrically located on either side of said vertex between the said lifting planes.

2. In a load-carrying air-supported structure, the combination of a pair of similar lifting surfaces each being triangular in form and having an acute angle, said surfaces being joined along one similar side of each constituting a leg of said acute angle, the planes being co-joined in predetermined angular relationship, said acute angles forming the forward end of the structure, the angle between the two lifting planes being constant throughout the length thereof; there being a towing point located in the vertex of said angle between said two planer surfaces and two load-holding points in the rear of said structure spaced apart transversely of the structure and near the rear upper edge of said surfaces.

3. In a load-carrying air-supported structure, the combination of a pair of similar triangular lifting surfaces having an acute angle, said surfaces being joined along one similar side of each in predetermined angular relationship, said acute angles forming the forward end of the structure, a towing point located in the vertex of said angle between said two surfaces and a pair of load-holding points in the rear of the structure symmetrically positioned with respect to said vertex between the two lifting planes, the said angle between the two lifting planes exceeding 90 degrees and being less than 140 degrees.

4. In an aerial sign-supporting structure, the combination of a pair of similar triangularly-shaped supporting surfaces each whereof has an acute angle, said surfaces being joined along a similar side of each at a predetermined angle, and with said acute angles at the forward end of the structure; a towing point positioned in the middle and near the forward end of the structure, a pair of load-carrying points located equidistantly apart from the middle and at the rear end of the structure, the distance of said towing point from the front end being less than one fourth the total length thereof.

5. In an aerial sign-supporting structure, the combination of a pair of similar, triangularly-shaped supporting surfaces each whereof has an acute angle, said surfaces being joined along a similar side of each at a predetermined angle, and with said acute angles at the forward end of the structure; a towing point positioned in the middle and near the forward end of the structure, a pair of load-carrying points located equidistantly apart from the middle and at the rear end of the structure, the distance of said load-carrying points from the upper edge of the structure being less than 35 per cent of the altitude of the rear end.

6. In an aerial sign-supporting structure, the combination of a pair of similar triangularly-shaped supporting surfaces each where-

of has an acute angle, said surfaces being joined along a similar side of each at a predetermined angle, and with said acute angles at the forward end of the structure; a towing point positioned in the middle and near the forward end of the structure, a pair of load-carrying points located equidistantly apart from the middle and at the rear end of the structure, the distance of said towing point from the front end being less than one fourth the total length thereof, the distance of said load-carrying points from the upper edge of the structure being less than 35 per cent of the altitude of the rear end.

In testimony whereof, I have signed my name to this specification at Fort Worth this 23rd day of December 1932.

WESLEY M. GRAY.