# United States Patent [19]

**Battles**

[11] **3,920,201**

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[54] **PILOTLESS GLIDER CONSTRUCTION**


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[52] **U.S. Cl.** ..... **244/16;** 46/79; 244/153 R

[51] **Int. Cl.**[2] ..... **B64C 31/02**

[58] **Field of Search** ..... 244/153 R, 155 R, 155 A, 244/16, DIG. 1; 46/79; 285/423



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[57] **ABSTRACT**

A delta wing type of pilotless glider wherein a weight is supported a spaced distance below the delta wing and is mounted so as to be movable transversely and longitudinally with respect to the wing in order to vary the flight of the glider according to the type of conditions encountered. The wing structure of the glider also includes a longitudinal center keel spar which is to be bowed in a upward direction which aerodynamically substantially improves the flight of the glider.


**8 Claims, 7 Drawing Figures**

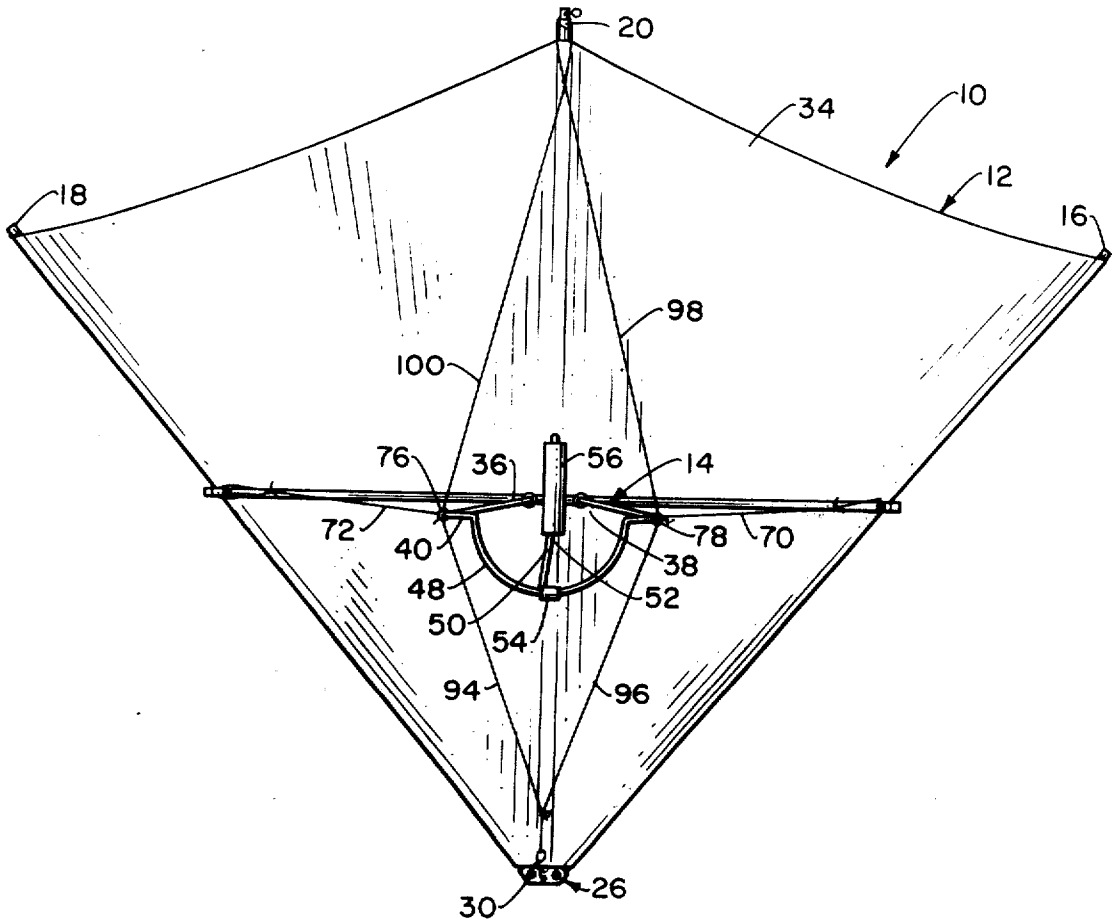


Fig. 1.

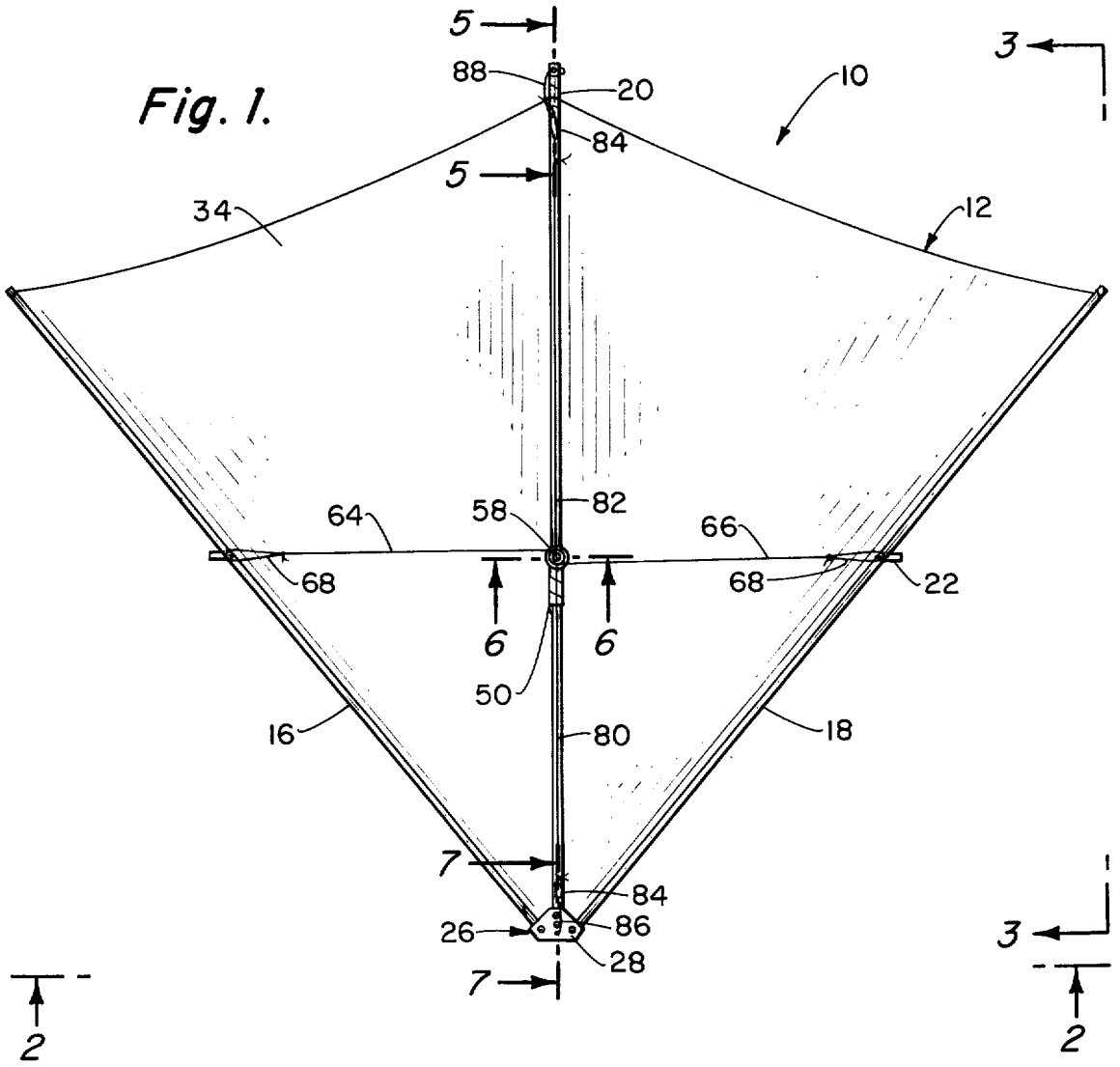

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Fig. 2.

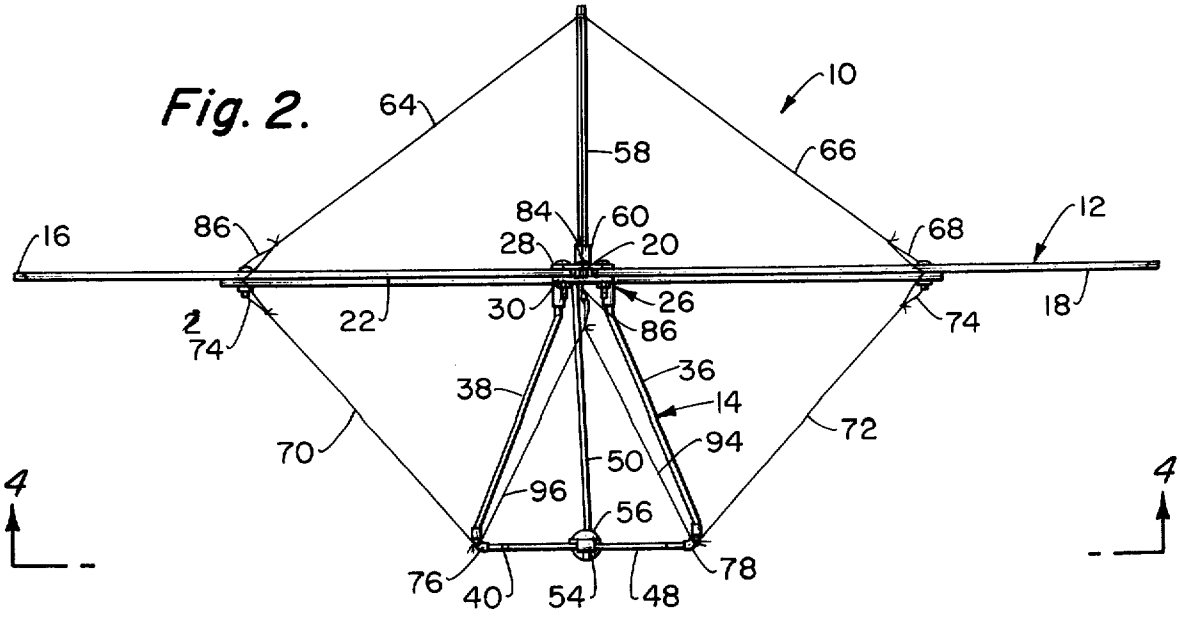

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Fig. 3.

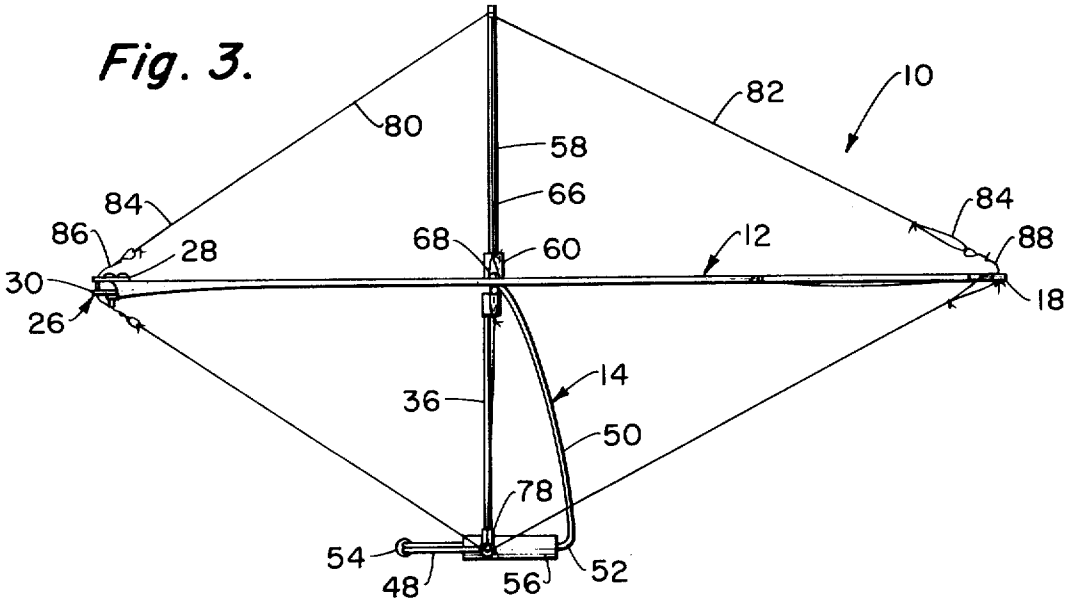

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Fig. 4.

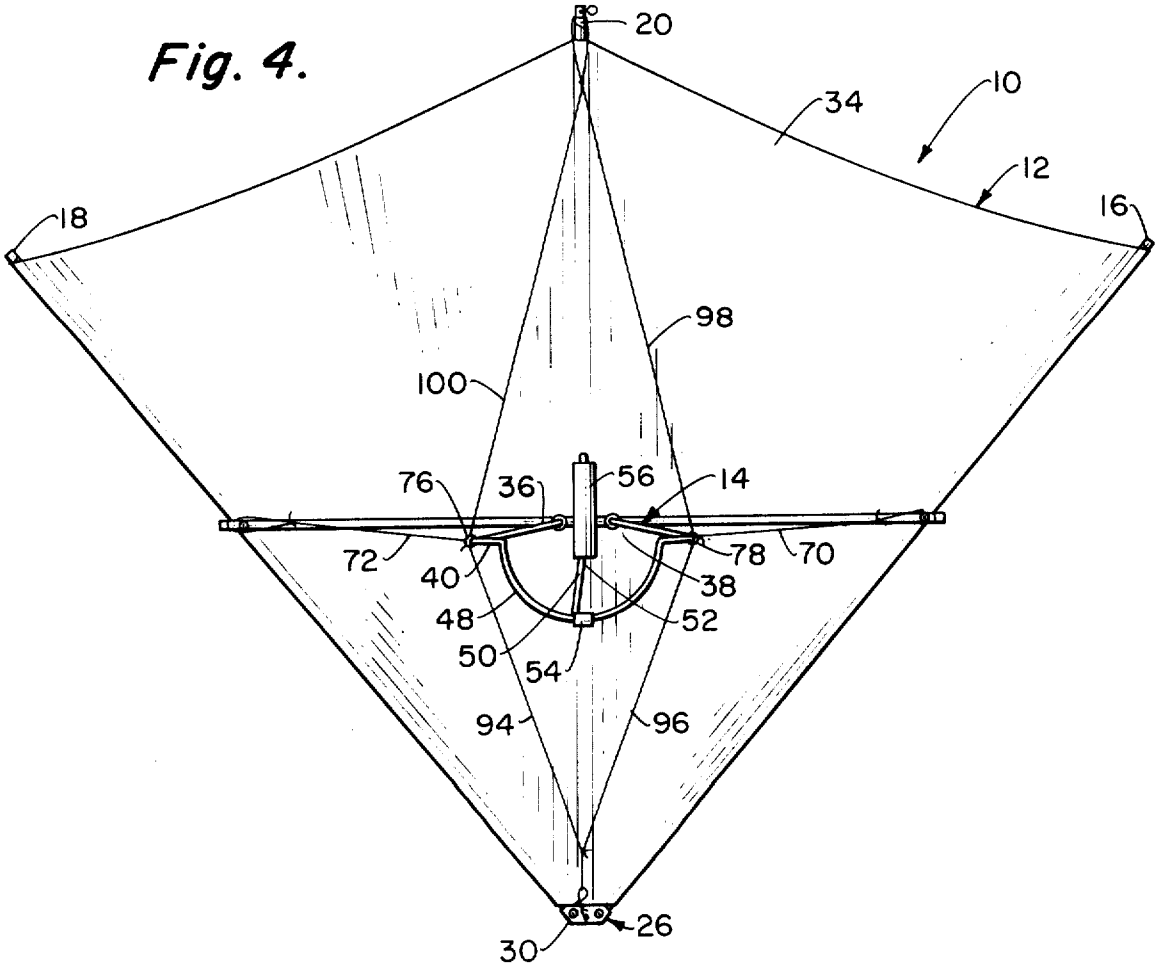

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Fig. 5.

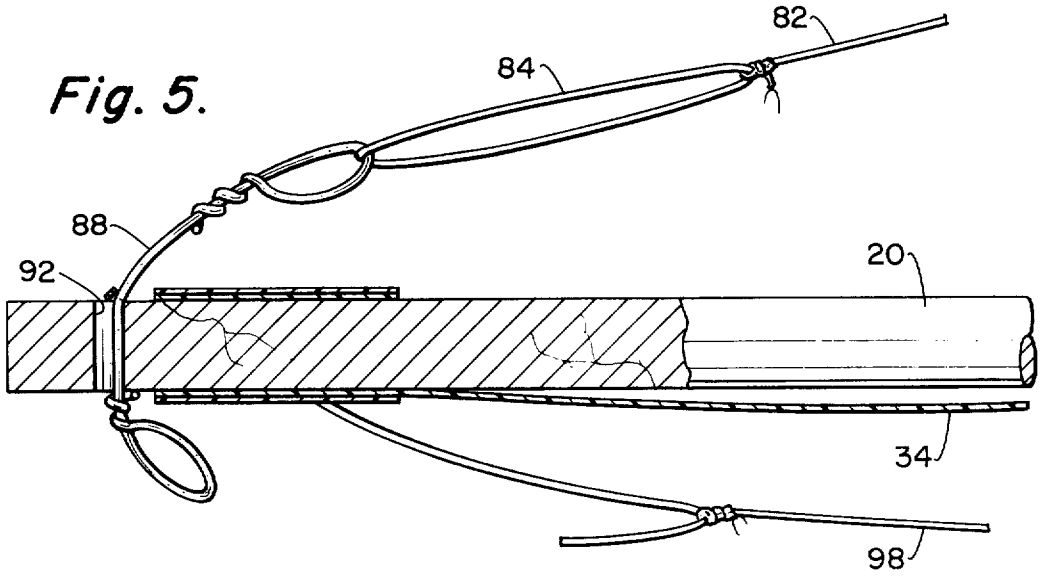



Fig. 6.

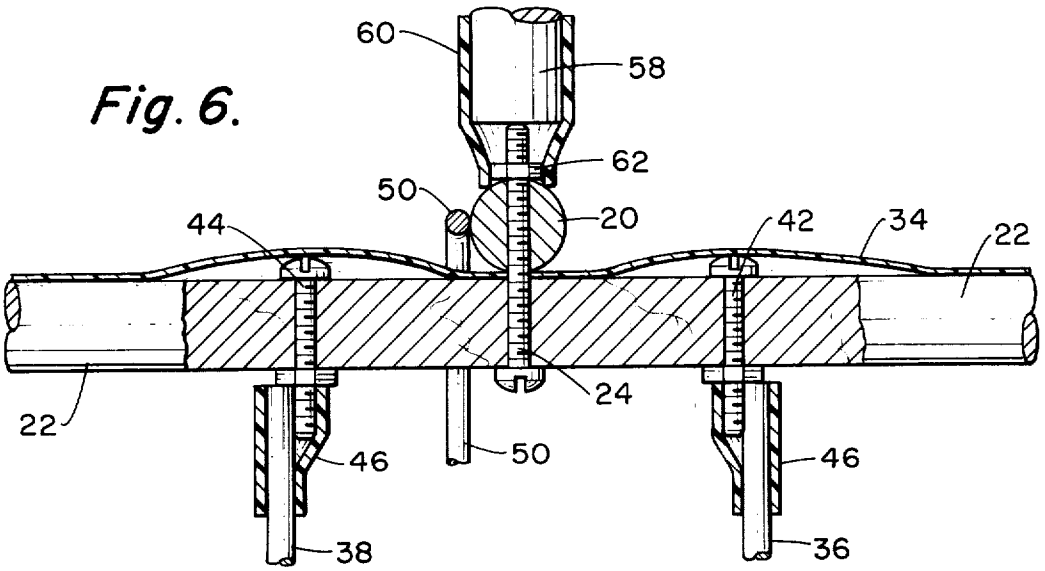
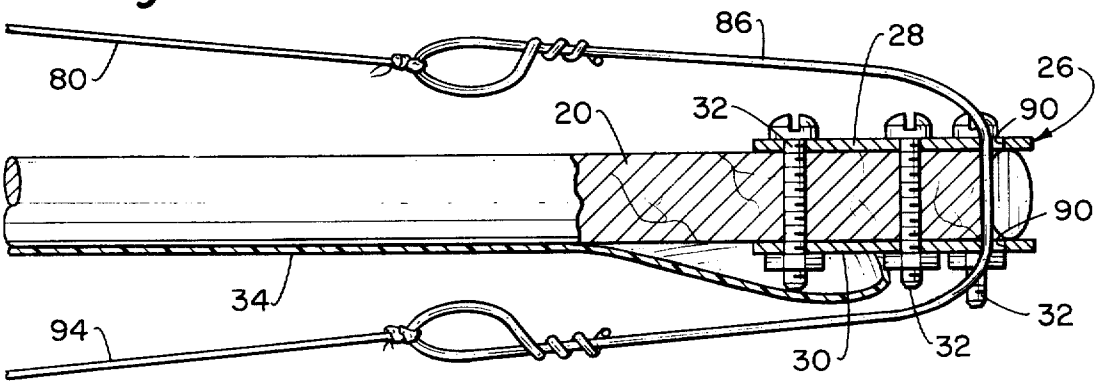



Fig. 7.



# PILOTLESS GLIDER CONSTRUCTION

## BACKGROUND OF THE INVENTION

The delta wing (trade named Rogallo) kite of about two hundred square feet in area has become very popular as a man carrying "hang glider". The pilot is suspended by a harness from the approximate center of gravity (and center of lift) of the kite. To fly, the pilot runs down a slope into the wind and, as he pushes against a rigid control bar suspended below the kite, the nose tilts upward giving the glider a positive angle of attack and permits the wind to lift the glider from the ground. The pilot then glides down the slope and lands facing the wind and by pushing the nose of the glider upward with the control bar, the glider stalls a foot or so above the ground with the pilot landing gently on his feet.

The weight of the pilot provides the attitude control of the glider to thus control stalls, dives and banking turns. The control bar, through which the attitude control is provided, supplies a rigid reference integral with the glider by which the pilot may quickly shift his weight and thus control the glider flight.

An important feature of a hang glider is for the center keel spar to have a slight upward bend in the neighborhood of a few inches. This is so the glider will have a tendency to come out of a dive with the nose up. A downward bow in the keel spar tends to cause the glider to nose dive and makes the glider unsafe in a dive.

Previously, there has been no known type of pilotless glider in which the delta wing type of glider can be controled in substantially the same manner as a piloted type of glider.

## SUMMARY OF THE INVENTION

The structure of this invention employs a delta wing structure in which a weight, simulating the weight of a pilot, is attached to the pilotless glider of this invention, the weight being movable with respect to the wing in order to control the flight of the pilotless glider. Once the weight is moved, it is fixed in this position to which it is moved and maintains its position during the entire flight. The pilotless glider of this invention is substantially one-sixth scale to the piloted version. The keel spar is bowed through a tensioned guy wire arrangement so that the pilotless glider will have a tendency to always maintain the nose upward as it is conducted through the air and tends to retard the nose dive.

The structure of this invention will have the appearance and approximate the performance of the piloted type of glider.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of the glider construction of this invention;

FIG. **2** is a front view of the glider construction of this invention taken along line **2—2** of FIG. **1**;

FIG. **3** is a side view of the glider construction of this invention taken along line **3—3** of FIG. **1**;

FIG. **4** is a bottom view of the glider of this invention;

FIG. **5** is a cross-sectional view through the aft portion of the keel spar within the glider of this invention taken along line **5—5** of FIG. **1**;

FIG. **6** is a cross-sectional view through the center post within the glider of this invention taken along line **6—6** of FIG. **1**; and



FIG. **7** is a cross-sectional view through the forward portion of the keel spar taken along line **7—7** of FIG. **1**.

## DETAILED DESCRIPTION OF THE SHOWN EMBODIMENT

Referring particularly to the drawings, there is shown the glider **10** of this invention which is composed basically of a wing structure **12** and a control bar **14**. The wing structure **12** is basically in the shape of a triangle wherein each side of the triangle is of equal length. This type of wing structure is termed a delta type of wing. The wing structure **12** includes a right leading edge spar **16** and a left leading edge spar **18**. Also included with the wing structure is a center spar or a keel spar **20**. The keel spar **20** is centrally spaced between the spars **16** and **18** and extends longitudinally of the glider **10** in substantially the direction of flight. The spars **16, 18** and **20** are formed of a rigid rod material, such as a wood doweling.

Also included within the wing structure is a cross boom **22**. The cross boom **22** extends substantially transversely across the glider and is positioned substantially perpendicular to the keel spar **20**. The cross boom **22** is also formed of a rigid rod material such as a wood doweling. The cross boom **22** is to be positioned to substantially cross the center of gravity of the glider **10**. The cross boom **22** is connected as by means of a screw fastener **24** to the keel spar **20** and is located therebeneath. The edges of cross boom **22** are respectively attached by means of a similar fastener to the leading edge spars **16** and **18**.

A nose plate assembly **26** is located at the foremost edge of the glider **10**. The nose plate assembly **26** includes an upper plate **28** and a lower plate **30**. Screw fasteners **32** are employed which connect together the upper plate **28** to the lower plate **30**. These fasteners are also by the forward most ends of the spars **16, 18** and **20** between the plates **28** and **30**. The angular position between the spars **16** and **18** as well as the position of spar **20** can be adjusted prior to securely tightening of fasteners **32**. The angle between spars **16** and **18** will be about eighty degrees. Extending between the spars **16** and **18** and fastened securely thereto is a thin, flexible, plastic sheet **34**. The sheet **34** when stretched tight forms about a 86° frontal angle thus providing 3° of slack on either side of the keel spar **20**. This slack provides a billow and a steadying "keel" effect when the glider is flown.

The control bar **14** includes legs **36** and **38** which are connected together through a base **40**. The ends of the legs **36** and **38** are connected through the fasteners **42** and **44**, respectively to the crossboom **22**. The connection to the crossboom **22** may be by means of a plastic tube **46** which stretches over the ends of the fasteners **42** and **44** and is also placed over its respective leg **36** and **38**. This tubing **46** may be comprised of a rubber tubing such as a surgical rubber tubing. The base **40** also includes a recess section **48**, the function of which will be explained further on in the specification.

About one inch along the edge of spars **16** and **18**, the plastic sheet **34** is to be wrapped tightly thereover. This wrapped position can be maintained by means of adhesive tape or some other type of conventional fastening means.

A wire support **50** is employed with one end of such adhesively secured to the keel spar **20**. The wire support **50** then is conducted through an opening in the wing **34** just on the aft side of the crossboom **22** and extends adjacent the base **40** of the cross control bar **14**.

The lower end 52 of the wire 50 is formed substantially parallel to the keel spar 20 and is connected through a rubber tubing 54 to the base 40, specifically in the area of the recess section 48. Mounted upon the end 52 is a weight 56, such as a lead weight. The weight 56 is movable upon the wire 50 and once it is positioned upon the wire 50, it is frictionally held thereon and maintains that position until it is manually moved therefrom. It is desirable that the weight 56 be positioned substantially along the vertical axis of the center of gravity of the glider 10. To achieve this purpose, the recess section 48 is employed so that the weight 56 can be positioned substantially as desired. The operator can then move the weight 56 slightly forward of the center of gravity, or slightly aft of the center of gravity, if desired along the wire 50. The reason for this movement may be to achieve particular types of flights, such that if it was moved forward along the wire 50 the glider will tend to nose dive, where if its moved to the aft direction the nose of the glider 10 will be inclined upwardly with respect to the ground. Also, in order to achieve desired left turns or right turns of the glider 10, the operator may move the weight 56 to the left or right by moving the end 52 with respect to the recess section 48 by physically moving the tubing 54.

At approximately the center of gravity of the keel spar 20, a center post 58 is positioned against the fastener 24. A flexible rubber tubing 60 cooperates over the lower end of the center post 58 and surrounds the nut 62 which connects with fastener 24. The position of the center post is thereby established but is permitted a certain amount of movement due to the connection by means of the tubing 60.

A transverse guy wire assembly is employed which consists of an upper guy wires 64 and 66 which are wound around the center post 58 adjacent its upper end thereof and are respectively connected to the leading edge spar 16 and 18. The connection with the spar 16 and 18 is established at the point of connection with the crossboom 22. In order to achieve a certain amount of flexibility in the connection with the guy wires 64 and 66, a rubber extendible band 68 connects its respective guy wire 64 and 66 to the crossboom 22.

A lower transverse guy wire assembly is also employed similar to the upper transverse guy wire and constitutes guy wires 70 and 72. The guy wires 70 and 72 also are connected to the crossboom 22 by means of rubber bands 74. The opposite end of the guy wire 70 and 72 are secured to the control bar 14 adjacent the base 40. This connection can be established upon the control bar 14 by means of the use of the rubber tubing members 76 and 78. The guy wires 64, 66, 70 and 72 function to provide a lateral stability to the glider 10 and laterally fix the position of the control bar 14 with respect to the spars 16 and 18 and also the position of the center post 58. The guy wires 64, 66, 70 and 72 can be of any string, wire or lanyard type of material and could be of even plastic strips.

Also employed within this invention is a longitudinal guy wire assembly comprising upper guy wires 80 and 82. The guy wires 80 and 82 are also wrapped around the center post 58 and the ends of such are also connected to rubber bands 84. The bands 84 are in turn connected to a forward slideable wire 86 and an aft slideable wire 88. The wires 86 are slideably mounted within an aperture 90 formed within the nose plates 28 and 30. The sliding wire 88 is slideably mounted within aperture 92 formed within the aft end of the keel spar 20. The wire 88 can be moved within its respective aperture 92 to assume different positions and that position being maintained by merely bending of the wire 88 when the desired position has been attained. In a similar manner, the wire 86 can be moved within its aperture 90 and that position also being fixable. The movement of the wires 86 and 88 is so as to attain a slight, upward bow to the keel spar 20. This slight upward bow is important as it is necessary in order to prevent the glider 10 from tending to "nose dive". The amount of upward bow of the keel spar 20 can be controled by controlling the amount of movement of the movable wires 86 and 88.

Located beneath the glider 10 is a lower longitudinal guy wire assembly comprising a forward pair of guy wires 94 and 96 which are connected to the movable wire 86. The guy wires 94 and 96 are also attached at opposite ends of the base 40 and specifically one each to tubular members 76 and 78. An aft lower longitudinal guy wire assembly is employed comprising guy wires 98 and 100. The guy wires 98 and 100 are also connected to the tubular members 76 and 78 and are in turn connected to the aft end of the keel spar 10. The guy wires 98, 100 and 94 and 96 cooperate with the guy wires 80 and 82 to provide longitudinal stability to the glider 10 and also function to position the glider 10 so that the keel spar 20 is in the upwardly bowed condition. When all these guy wires are tight, the glider is rigid and will holds its shape when in flight. The use of the elastic bands 68 and 84, which are stretched moderately when the guy wire strings are rigged, hold the guy wire strings tight at all times even though the glider 10 may encounter a sudden wind force.

What is claimed is:

1. A pilotless glider comprising:
a wing structure;
a control bar attached to the underside of said wing structure;
a weight connected to a supporting wire, said supporting wire being attached to said wing structure and connected by connecting means to said control bar, said connecting means permitting transverse adjustment of said weight in respect to said control bar, said weight located a spaced distance beneath said wing structure, said weight movably mounted upon said supporting wire;
said control bar being trianqularly shaped with the base of the trianqularly shaped control bar being positioned substantially crossways to the line of flight of the glider; and
said base of said triangularly shaped control bar including a bowed section, said connecting means being movable along said bowed section, whereby said weight is movable both transversely and longitudinally with respect to said wing as said connecting means is moved upon said bowed section.

2. The pilotless glider as defined in claim 1 wherein:
said control bar located substantially at the center of gravity of said wing, said weight being positioned substantially through a vertical line passing through the center of gravity of said wing.

3. The pilotless glider as defined in claim 2 wherein:
the adjustment of said weight upon said supporting wire being substantially longitudinally with respect to said wing.

4. The pilotless glider as defined in claim 3 wherein:
said connecting means comprises a section of rubber tubing, said rubber tubing frictionally engaging said

control bar.

5. The pilotless glider as defined in claim 4 wherein:
the plane of the adjustment of said weight being substantially parallel to the plane of said wing.

6. The pilotless glider as defined in claim 5 wherein:
said wing structure includes a keel spar extending longitudinally through the center of said wing, said keel spar being constructed as a substantially rigid rod, a center post connected to said keel spar and extending substantially perpendicular therefrom above said wing;

a longitudinal guy wire assembly connected to said center post, said longitudinal guy wire assembly connected through attaching means to the fore and aft end of said keel spar, said attaching means including structure to vary the tension of said longitudinal guy wire assembly, whereby said keel spar may be caused to assume a slightly upward bow by adjusting of the tension of said guy wire assembly to thereby facilitate of said glider through the air.

7. The pilotless glider as defined in claim 6 wherein:
said longitudinal guy wire assembly including guy wires extending beneath said wing and interconnecting the fore and aft end of said keel spar to said control bar.

8. The pilotless glider as defined in claim 7 including:
said wing structure including a cross boom, said cross boom located substantially transversely across said wing through the approximate center of gravity of said wing, an upper transverse guy wire assembly interconnecting said center post and the fore and aft ends of said cross boom, a lower transverse guy wire assembly interconnecting the fore and aft ends of said cross boom and said control bar, the connections between said upper and lower transverse guy wire assembly to said cross boom being established through rubber resilient expandible means.

* * * * *