Feb. 20, 1968 D. A. BROWN 3,369,319

TOY GLIDER WITH AUTOMATIC WING CONVERGING MEANS

Filed June 11, 1965 2 Sheets-Sheet 1

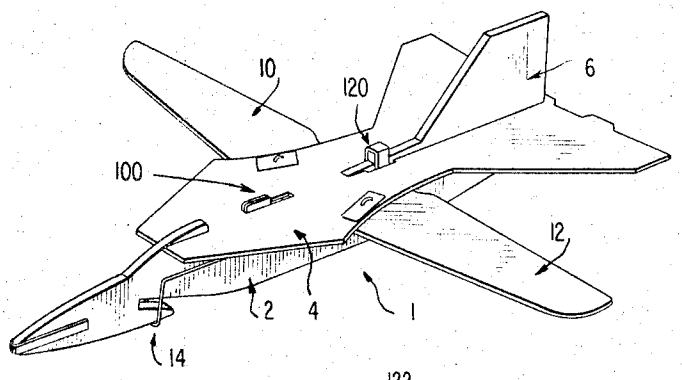

FIG. 1

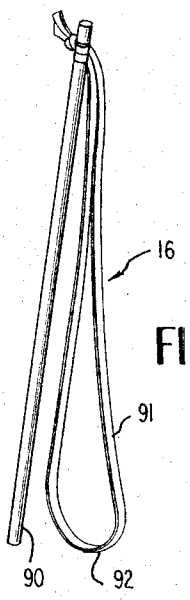

FIG. 2

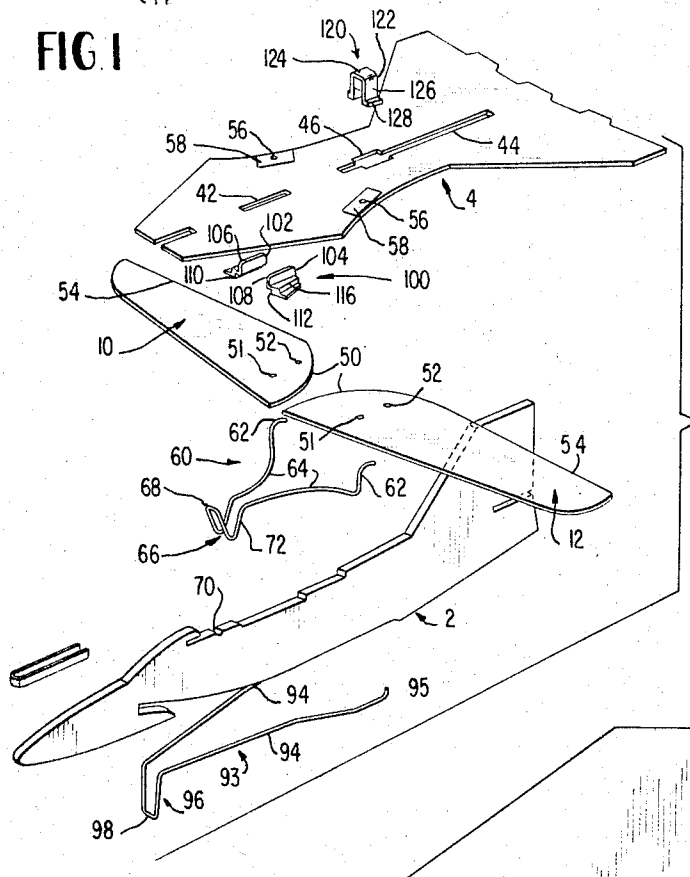

FIG. 5

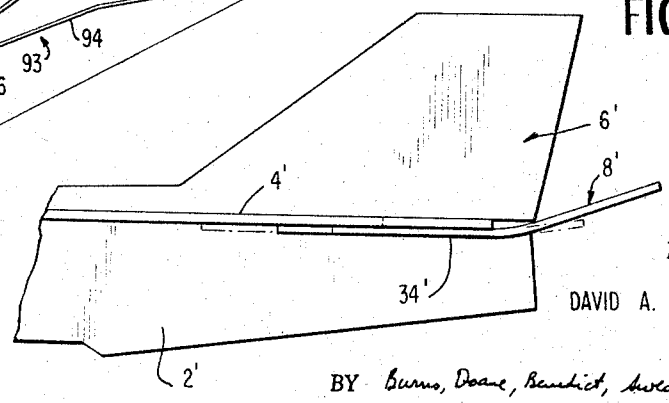

FIG. 10

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FIG. 3

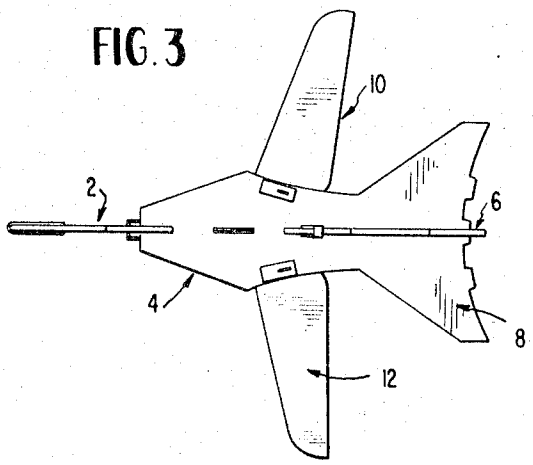


FIG. 4

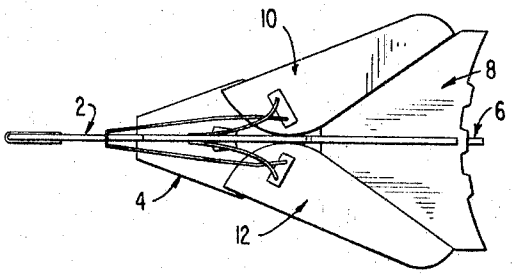


FIG. 6

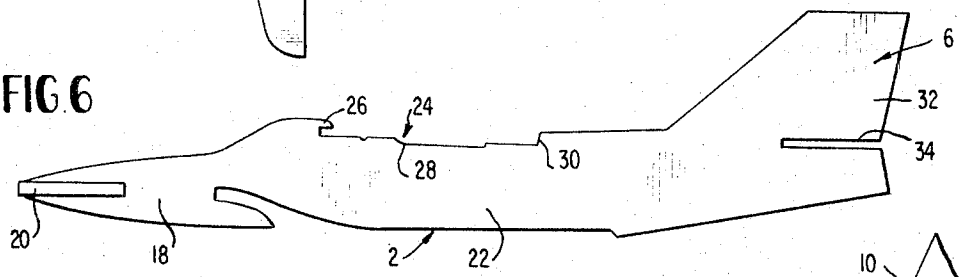


FIG. 7

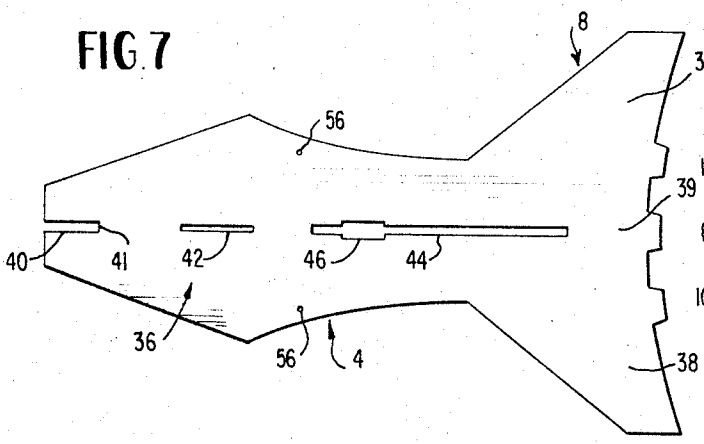


FIG. 9

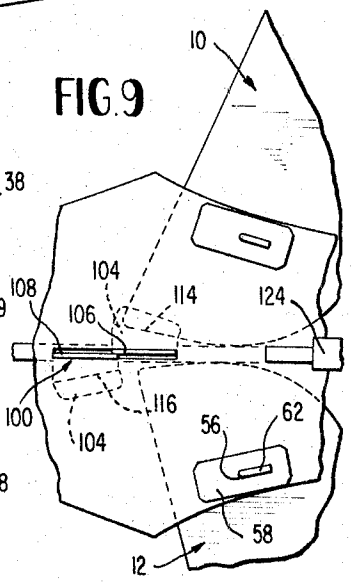
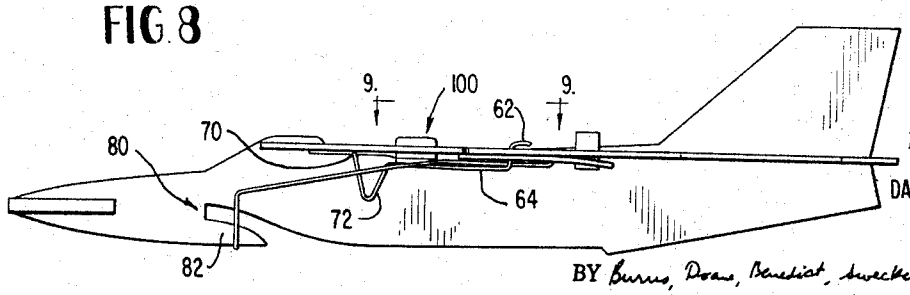


FIG. 8



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3,369,319

TOY GLIDER WITH AUTOMATIC WING CONVERGING MEANS

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11 Claims. (Cl. 46—80)

ABSTRACT OF THE DISCLOSURE

A variable sweep-wing toy glider adapted to be launched by a launching device includes a fuselage having a pair of wings positioned on opposite sides of the fuselage. First and second pivot points connected with the fuselage on opposite sides thereof mount the wings to the fuselage for pivotal motion from a converged position in which the wings extend rearwardly and outwardly from the pivot points at one angular inclination to the fuselage to an extended position at which the wings are disposed at a larger angular inclination. A V-shaped spring is connected at two transversely opposed points by swivel connections to the wings. The points of swivel connection are spaced transversely inwardly and longitudinally rearwardly of the pivot points with the spring urging the points of swivel connection transversely apart. The spring is mounted for longitudinal motion relative to the fuselage and is adapted to be contacted by the launching device during the launching operation. During launching the spring is moved forwardly relative to the fuselage to rotate the points of swivel connection forwardly and transversely inwardly about the pivot points thereby rotating the wings rearwardly to the converged position and concurrently compressing the spring. On the release of the launching device in the fuselage the spring urges the points of swivel connection outwardly to rotate the wings forwardly about their pivot points to the extended position.

This invention relates to toy gliders and more particularly to toy gliders of the variable sweep wing type.

Heretofore toy gliders have been available wherein the wings thereof are of variable sweep, i.e., are pivotal in a horizontal plane from a forward spread position to a rearward converged position. Such variable sweep wing design has been found advantageous in a toy glider because during the first stages of forced flight following launching by a sling shot-like launcher, the wings may assume a collapsed condition to facilitate high-speed skyward projection in an arrow-like form. However, upon reaching the apex of the trajectory, the wings may assume a forward spread condition to provide the desired lower speed gliding action of the toy glider back to earth. Such toy gliders have not always been satisfactory heretofore because their design made inconvenient the operation of launching the glider with the wings thereof held in a converged position. Further, the toy gliders heretofore available could not generally be properly adjusted as to flight or glide pattern or have lacked the structural integrity required for sustained usage.

In recognition of the need to provide a variable sweep wing toy glider that substantially eliminates or minimizes the problems heretofore discussed, it is a general object of this invention to provide such a toy glider.

More specifically, it is an object of this invention to provide a variable sweep wing toy glider that is convenient to launch with the wings thereof in a converged position.

It is a further object of this invention to provide such a toy glider wherein means are provided to adjust both the skyward trajectory and/or the glide pattern.

It is another object of this invention to provide a variable sweep wing toy glider that is convenient to assemble and which provides the structural integrity required by sustained usage.

In achieving these and other objects that will become apparent hereinafter, the present invention provides a variable sweep wing toy glider adapted to be launched by a launching device, the glider comprising a fuselage, a tail assembly associated with the fuselage, and a pair of wings pivotally mounted on the fuselage. Mounting means are provided for pivotally connecting the wings to the fuselage for movement from a forward spread position to a rearward converged position. A launching device engagement means is operatively associated with the fuselage, the engagement means being adapted to be engaged by the launching device during the launching operation. To facilitate convenient launching of the toy glider with the wings in the converged position, connecting means are operatively associated with the engagement means and the wings for pivoting the wings to a converged position responsive to launching engagement of the engagement means with the launching device.

To facilitate achieving the desired flight pattern of the toy glider, adjustment means may be provided to regulate the forward or spread position of each of the wings whereby banking movement to the right and left of the toy glider during the flight pattern may be governed. To aid in controlling the initiation of the glide pattern, adjustment means may be provided to regulate the extent to which the wings may be converged. Still further, to aid in controlling the pitch of the toy glider during the flight pattern, the tail wing assembly of the instant toy glider may be made adjustable.

Finally, the present invention includes a lock-type structural connection between the elements of the toy glider fuselage and tail assembly that is both convenient to assemble and yet provides structural integrity to resist the impact forces encountered during operation of a toy glider according to the present invention.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective view of a variable sweep wing toy glider according to the present invention;

FIGURE 2 is a perspective view, on a slightly enlarged scale, of a slingshot-type launcher that may be utilized to launch the toy glider shown in FIGURE 1;

FIGURE 3 is a top view, in a reduced scale, of the toy glider shown in FIGURE 1 with the wings thereof shown in the forward or spread condition as assumed during the glide pattern;

FIGURE 4 is a bottom view, in a reduced scale, of the toy glider shown in FIGURE 1 but shown with the wings thereof in the converged position as assumed during the launching process;

FIGURE 5 is a perspective, blown up view of the toy glider shown in FIGURE 1;

FIGURE 6 is a side view of a vertical fuselage section of the toy glider shown in FIGURE 5;

FIGURE 7 is a top view of a horizontal fuselage section of the toy glider shown in FIGURE 5;

FIGURE 8 is a side view of the assembled toy glider shown in FIGURE 5;

FIGURE 9 is a top view similar to that shown in FIGURE 3 but on an enlarged scale to show the details of the bank adjustment; and

FIGURE 10 is a side view of a modified form of the present invention with parts thereof broken away for convenience in illustration, wherein an adjustable tail wing assembly is provided.

Referring in more detail to the FIGURE 1 of the drawings, a variable sweep wing toy glider according to the present invention generally includes a fuselage 1 formed

of slightly flexible balsa wood or the like and including a vertical fuselage section 2 and a horizontal fuselage section 4 connected together in a perpendicular relationship. The vertical fuselage section 2 includes a tail rudder assembly 6 and the horizontal fuselage section 4 includes a tail wing assembly 8. A pair of pivotally mounted right and left wings, 10 and 12 respectively, also constructed of balsa wood or the like, are connected to the fuselage. A launcher engagement assembly 14 is provided on the forward end of the vertical fuselage section 2 and is adapted to be engaged by a launching device 16, as shown in FIGURE 2, to launch the glider in a flight trajectory wherein the wings initially assume a high speed rearwardly converged or collapsed position, as shown in FIGURE 4, but can assume a forward spread condition as shown in FIGURE 3 during the glide pattern.

More specifically, the vertical fuselage section 2 as shown in FIGURES 3 and 6 includes a nose 18 on the forward end of which a U-shaped bumper 20 of metal or the like is fixed to aid in resisting impact forces that might be encountered during operation, and to move forwardly the center of gravity of the overall glider for proper flight characteristics. An intermediate or body portion 22 of the vertical fuselage section 2 includes an elongated recess 24 on the upper end thereof. The recess is defined by a vertically spaced rearwardly extending lip 26 projecting rearwardly over the forward end of the recess, a generally horizontally extending middle portion 28 and a vertically extending rearward shoulder 30. The rear end of the vertical fuselage section 2 includes an upwardly projecting tail assembly rudder 32 including a forwardly projecting slot 34 in the rear end thereof.

Referring to FIGURES 3 and 7, the horizontal fuselage section 4 includes a generally diamond-shaped intermediate or body portion 36 integral with a pair of rearwardly diverging tail wings 38 and an intermediate portion 39 therebetween forming the tail wing assembly 8. The forward end of the horizontal fuselage section body 36 is provided with an elongated rearwardly extending slot 40, the rear end of which is defined by a shoulder 41, an elongated adjustment control opening 42 disposed to the rear of the slot 40, and an elongated, rearwardly positioned, vertical - fuselage - section - receiving opening 44. A forward end of the opening 44 includes a widened portion 46 to receive an adjustment mechanism as will appear hereinafter.

The design and the method of assembly of the vertical and horizontal fuselage sections is considered to be of significance in lending structural integrity to a toy glider according to the present invention. To assemble these elements the tail rudder 32 is inserted in the elongated opening 44 in the horizontal fuselage section 4 to vertically align the intermediate portion 39 between the tail wings 38 with the slot 34 in the rear end of the tail rudder 32. The horizontal fuselage section 4 is then moved in a forwardly direction while depressing the slightly resilient forward end thereof adjacent the slot 40. Because the spacing between the rearward end of the slot 40 and the forward end of the elongated opening 44 is greater than the spacing between the rearward end of the lip 26 and the shoulder 30 defining the recess 24 in the vertical fuselage section, the shoulder 41 at the end of the slot 40 must be depressed and inserted in the recess 24 beneath the lip 26 and advanced to a forward position before the forward end of the elongated opening 44 of the horizontal fuselage section 4 may be positioned within the recess 24 and about the shoulder 30 defining the rear end thereof. In this position the rear end of the elongated opening 44 abuts the forward end of the slot 34 in the tail assembly 6 to prohibit forward movement, the forward end of the opening 44 abuts the shoulder 30 to prohibit rearward movement and vertical movement between the vertical and horizontal fuselage sections 2 and 4 is prohibited by abutment of the shoulder 41 with the generally horizontal bottom of the recess 24 and the lip 26 at the forward end and by abutment of the central portion 39 of the tail wing assembly 8 with the shoulders defining the slot 34. In this position, purely longitudinal or vertical movement between the horizontal and vertical fuselage sections is impossible without rupturing these elements. Disassembly may only be achieved by upward deflection of the body 36 adjacent the forward end of the elongated opening 44 of the horizontal section and the shoulder 30 on the vertical section and, at the same time, by rearward movement of the horizontal section relative to the vertical section. In this manner, a structural lock is conveniently achieved between these elements that is considered to offer appreciable advantages in a toy glider environment wherein other than purely axial loads are not frequently encountered.

As apparent in FIGURES 3 and 4, the wings 10 and 12 are mounted on the fuselage 1 for movement between a forwardly spread condition wherein the sweep of the wings or angle between the leading edge thereof and a line perpendicular with the longitudinal axis of the toy glider is approximately 15–20°. In the collapsed position, as shown in FIGURE 4, the sweep of the wing is approximately 70–75°. To facilitate pivotally mounting of the wings 10 and 12 on the fuselage 1, the inner ends 50 are rearwardly outwardly curved and are provided with a pair of spaced forward and rearward bores 51 and 52. It should be noted that each of the rearward bores 52 are positioned slightly inwardly relative to the forward bores 51 for purposes that will appear hereinafter. A trailing edge 54 of each of the wings may be downwardly curved to provide the desired flight characteristics as shown in FIGURE 8. The body portion 36 of the horizontal fuselage section 4 is provided with an aperture 56 on either lateral side thereof which may be suitably reinforced by thin metallic plates 58 fixed on the upper face of the horizontal fuselage section 4. As best seen in FIGURE 5, a generally V-shaped wing spring 60 is provided with rearwardly positioned curved hooks 62 on the upper ends of the legs 64 thereof, the lower ends of which are connected in the form of a downwardly projecting stirrup 66 including a horizontal portion 68. As shown in FIGURE 8, the horizontal portion 68 of the spring 60 is received within a groove 70 in the forward end of the recess 24 in the vertical fuselage section 2. The legs 72 of the stirrup 66 project on either side of the vertical fuselage section as do the legs 64 of the V-shaped wing spring 60 which extend rearwardly. The curved hooks 62 project through the forward bores 51 in the wing and the apertures 56 in the horizontal fuselage section 4 to pivotally connect the horizontal fuselage section 4 to the wings 12 and 10 and to sandwich the wing spring 60 in a fixed position between the sections of the fuselage. Another spring, discussed hereinafter, is effective to pivot the wings about the axes of the hooks 62 of the spring 60 and to urge the wings 10 and 12 to the forward spread position as shown in FIGURE 3.

To project the instant toy glider with a launcher as shown in FIGURE 2, the vertical fuselage section is provided with a curved recess 80 (FIGURE 8), the lower portion of which is defined by a downwardly curved hook portion 82. A slingshot-like launcher or catapult 16 may be utilized, the launcher 16 comprising a staff or handle 90 to an upper end of which a loop of elastic material 91, such as a heavy rubber band or the like is connected. To launch the toy glider, the glider is grasped in one hand and the staff 90 of the launcher 16 in the other. A bite portion 92 of the elastic loop is inserted with the recess 80 in the vertical fuselage section 2 and the loop stretched in a slingshot-like manner while releasing the hold on the toy glider to project the same in the direction the launcher and toy are aimed. As will be appreciated, other suitable launching devices are available for use with the instant glider.

To achieve automatic collapse of the wings to the position shown in FIGURE 4 during the launching process, a launching device engagement spring 93 is provided. The

spring is of a V-shaped form, diverging legs **94** of which each include an upwardly projecting hook **95** on the rear end thereof. The other end of the V-shaped spring **93** includes a downwardly depending stirrup **96** having a horizontal portion **98**. When the wings are in the normally open position as shown in FIGURE 3 and the vertical fuselage section **2** is received between the legs **94** of the V-shaped spring **93**, the horizontal portion **98** of the stirrup **96** is positioned intermediate of and below the launching device engaging hook **82** defining the lower end of the recess **80** on the vertical fuselage section. The legs **94** extend above the legs **64** of the wing spring **60** and inwardly of the hooks **62** thereof. The hooks **95** on the rear ends of the V-shaped spring **93** are received in the rearward apertures **52** on the inner ends of the wings **10** and **12**, the upper ends of the hooks **95** extending through the apertures **52** but in spaced relation to the lower face of the horizontal fuselage section **4**. To collapse the wings during the launching process the bite portion **92** of the elastic loop **91** of the launcher **16** is positioned within the recess **80** of the vertical fuselage section. As the elastic loop **91** is stretched during the launching operation, the stirrup **96** is carried in a forwardly direction, the hooks **95** causing the wings **10** and **12** to pivot about the axis of the hooks **62**. In this manner the wings are automatically collpased in the correct position for and during the launching operation.

It should be noted that the spring rate of the spring **93** is selected to force the wings to the spread condition, as shown in FIGURE 3, when the wings undergo diminished air resistance as would be the case when the glider slows down after a substantial amount of travel after the launching initial high-speed stage. At this point, the spring **93** overcomes wind resistance forces tending to hold the wings in a collapsed position and urges them to the spread condition to provide the desired glide characteristics in the next stage of flight.

To adjust the glide pattern of the glider, banking adjustment or minimum wing sweep controls **100** are provided. As best seen in FIGURES 5 and 9, these controls comprise a pair of right and left, slidable step-shaped cams **102** and **104** the upper ends **106**, **108** of which are positioned in abutting relation and are received within and project through the opening **42** in the horizontal fuselage section and overlap the vertical fuselage section. Lower shoulder **110**, **112** are spaced laterally outwardly of the upper ends **106** and **108** so that the shoulders **110** and **112** slidingly abut the right and left sides, respectfully, of the vertical fuselage section **2** on either side of the recess **24**. The lower, outer faces of the cams **102** and **104** are provided with a cam surface **114** and **116** respectively, the cam surfaces sloping inwardly towards the rear. As shown in phantom lines in FIGURE 9, when the wings **10** and **12** are in the collapsed position one or both of the cams **102** and **104** may be moved horizontally from a forward position in the slot **42** so that the cam surfaces **114** and **116** may be positioned to abut the curved inner ends **50** of the wings so as to limit the extent of forward pivotal motion of the wings **10** and **12** about the axis of the hooks **62** as urged by the spring **93**. By individual adjustment of the cams **102** and **104** to adjust the minimum sweep of each wing, the center of pressure of the respective wing may be moved forwardly with the resulting tendency to lift that side of the glider causing the glider to roll and bank in the direction of the more rearward wing. With both cams positioned forwardly or rearwardly, the tendency to loop or to dive, respectively is increased.

Although the bank adjustment cams **102** and **104** are shown as projecting through the slot **42**, it is within the scope of this invention to eliminate the slot **42** and slidably retain the cams **102** and **104** below the horizontal fuselage section by sandwiching these cams between that section and the wing spring **60**.

To restrict the degree to which the wings may be converged or collapsed against the vertical fuselage section **2** of the glider, a maximum wing sweep adjustment control **120** is provided. As shown in FIGURE 5, this control includes a slidable stirrup **120** including a horizontal portion **124** which extends over the upper end of the vertical fuselage section **2**. Fixedly connected to the horizontal portion **124** is a pair of depending legs **126** which project downwardly through the wide portion **46** in the elongated opening **44** in the horizontal fuselage section **4** on either side of the vertical fuselage section. Fixed to the lower ends of the legs **126** so as to be inclined outwardly to the rear is a cam surface **128**. Depending upon the horizontal placement of the stirrup **120** within the enlarged portion **46** of the opening **44**, the degree to which the wings **10** and **12** may be converged may be restricted by abutment of the curved portion **50** with the cam surfaces **128**. In this manner maximum wing sweep may be restricted and the initiation of the glide pattern may be adjusted to vary the point at which the glider assumes a gliding condition after launching.

To adjust the glider pitch or the tendency of the glider to loop during the flight trajectory, a modified form of the present invention as shown in FIGURE 10 may include a movable tail wing assembly **8'** that is independent of and slidably positioned below the horizontal fuselage section **4** within a rearwardly upwardly curved slot **34'** provided in the tail rudder assembly **6'**. The tail wing assembly **8'** may be horizontally moved from a rearward position shown in full lines in FIGURE 10 wherein the rear of the tail wing is upwardly angled or curved to a forward generally straight position shown in phantom lines therein wherein the tendency of the glider to loop during the trajectory is minimized in accordance with the decreased length of the deflecting surface projecting rearwardly of the horizontal fuselage section.

While the invention has been shown and described with reference to a particular embodiment and one modification thereof, it will be obvious to those skilled in the art that various changes, modifications, may be made without departing from the invention disclosed herein in its broader aspects and it is intended that the appended claims cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. A variable sweep-wing toy glider adapted to be launched by a launching device, comprising:

a longitudinally extending fuselage having forward and rear ends,

a pair of wings positioned on opposite sides of said fuselage,

first and second pivot points connected with said fuselage, said first pivot point positioned on one side of said fuselage, said second pivot point correspondingly positioned on the opposite side of said fuselage, said wings connected at said pivot points with said fuselage for pivotal motion in a generally horizontal plane from a converged position in which said wings extend rearwardly and outwardly from said pivot points at one angular inclination to said fuselage to an extended position in which said wings are disposed at a relatively larger angular inclination to said fuselage,

V-shaped spring means connected at two transversely opposed points by swivel connections to said wings and extending therebetween, said points of swivel connection being spaced transversely inwardly and longitudinally rearwardly of said pivot points, said spring means urging said points of swivel connections transversely apart, said spring means further being mounted for longitudinal motion relative to said fuselage, said spring means being adapted to be contacted by the launching device during the launching operation and to be moved forwardly relative to said fuselage to rotate said points of swivel connection forwardly and transversely inwardly

about said pivot points upon such contact thereby rotating said wings rearwardly to said converged position and concurrently flexing said spring,

whereby upon release of the launching device from said glider said spring urges said points of swivel connection transversely outwardly to rotate said wings forwardly about their pivot points to said extending position.

2. A variable sweep wing toy glider according to claim 1 including minimum sweep adjustment means associated with said pair of wings for limiting the forward spread position of said wings.

3. A variable sweep wing toy glider according to claim 1 including minimum sweep adjustment means for limiting the forward spread position of each of said wings independently of the other.

4. A variable sweep wing toy glider according to claim 1 adjustable maximum sweep adjustment means for restricting said rearward converged position of said wings.

5. A variable sweep wing toy glider according to claim 1 further including a tail assembly having a vertically disposed rudder and a horizontally disposed tail wing slidably connected to said rudder, said tail wing being movable from a forward horizontal position to a rearward curved position.

6. A variable sweep wing toy glider adapted to be launched by a launching device, the glider comprising a fuselage, a tail assembly operatively connected to said fuselage, a pair of wings, mounting means pivotally mounting said wings on said fuselage for movement from a forward spread position to a rearward converged position, minimum sweep adjustment means operatively associated with said wings for independently limiting the forward position of each of said wings, maximum sweep adjustment means operatively associated with said wings for restricting the rearward converged position thereof, said tail assembly including a vertically disposed rudder and tail wing slidably connected to said rudder, said tail wing movable from a forward horizontal position to a rearward upwardly curved position, said fuselage further including launching device engagement means, said engagement means adapted to be engaged by the launching device during the launching operation, and connecting means operatively associated with said engagement means and operatively connected to said pair of wings for pivoting said wings to a converged position responsive to launching engagement of the engagement means with the launching device, said connecting means including spring means for urging said pair of wings to said forward spread position.

7. A variable sweep wing toy glider according to claim 2 wherein said fuselage comprises a vertical section including a horizontally extending slot in one end thereof and an elongated recess intermediate the length of said vertical section, said recess being defined by a horizontally extending lip projecting over one end thereof and a shoulder at the other end thereof, a horizontal section constructed of slightly flexible material, said horizontal section having a slot in one end thereof and an elongated opening intermediate the length of said horizontal section, a first portion of said horizontal section received in said slot in said vertical section, a first portion of said vertical section received in said elongated opening in said horizontal section, a second portion of said horizontal section received in said recess in said vertical section, one end of said second portion of said horizontal section positioned beneath said lip, and a second portion of said vertical section received in said slot in said horizontal section, adjacent extremities of said shoulder and said lip being spaced apart a distance less than the distance between adjacent extremities of said slot and said elongated opening of the horizontal section whereby a connection between said vertical and horizontal sections is provided that is resistant to axial operational impact loads.

8. A variable sweep wing toy glider adapted to be launched by a launching device, the glider comprising a vertical fuselage, section, a horizontal fuselage section connected to said vertical fuselage section in perpendicular relation thereto, a pair of wings, mounting means pivotally mounting said wings on said horizontal fuselage section for movement from a forward spread position to a rearward converged position, said mounting means comprising V-shaped wing spring means having hook means on one end thereof, said hook means pivotally connected to an inner end of each of said wings and said horizontal fuselage section, said V-shaped spring means including a stirrup on the other end thereof embracing the sides of said vertical fuselage section, launching device engagement means provided on said vertical fuselage section, including a recess defined by shoulder means, said engagement means adapted to be engaged by the launching device during the launching operation, and connecting means cooperatively associated with said engagement means and operatively connected to said inner ends of each of said wings for pivoting said wings to a converged position about the axis of said wing spring hook means responsive to launching engagement of said engagement means with said launching device, said connecting means comprising a V-shaped connecting spring for urging said pair of wings to said forward spread position, said connecting spring including hook means on one end thereof pivotally connected to said wing means rearwardly and inwardly of the pivotal connection of said wing spring hook means with said wings, said connecting spring including a downwardly extending stirrup on the other end thereof, said stirrup embracing said recess and shoulder means in said vertical fuselage section when said wings are in the spread position whereby launching engagement of the launching device with said recess and shoulder means moves said stirrup of said connecting spring to pivot said wings about the axis of said wing spring hook means.

9. A variable sweep wing toy glider comprising a vertical fuselage section, a horizontal fuselage section connected to the vertical fuselage section in perpendicular relation thereto, a pair of wings, the inner ends of which are spaced and outwardly curved towards the trailing edge thereof, mounting means pivotally mounting said inner ends of said wings on said horizontal fuselage section for pivotal movement of said wings about a vertical axis from a forward spread position to a rearward converged position, said mounting means including spring means urging said wings to said spread position, and minimum sweep adjustment means associated with said pair of wings for limiting the forward spread position of said wings, said adjustment means comprising slidable cam means slidably connected on each side of said vertical fuselage section, said cam means being slidable from a forward position remote from said inner ends of said wings to a rearward position wherein said cam means abut said inner ends of said wings to limit the forward pivotal movement thereof as urged by said spring means.

10. A variable sweep wing toy glider according to claim 9 including maximum sweep adjustment means for restricting the rearward converged position of said wings, said maximum sweep adjustment means associated with said pair of wings for restricting the rearward converged position of said wings, said maximum sweep adjustment means comprising a stirrup means slidably positioned about said vertical fuselage section, said stirrup means having cam surfaces on either side of said vertical fuselage section adapted to be moved from a rearward position remote from said inner ends of said wings to a forward position wherein said cam surfaces abut said inner ends of said wings to restrict the rearward converged position of said wings.

11. A variable sweep wing toy glider according to claim 10 wherein said vertical fuselage section includes a tail rudder means, said tail rudder means having a curved slot therein adjacent said horizontal fuselage section, and a tail wing means slidably received in said slot and mov-

able from a forward horizontal position to a rearwardly curved position.

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