Nov. 12, 1940. N. E. WALKER 2,221,012

TOY GLIDER

Filed Oct. 13, 1939 2 Sheets-Sheet 1

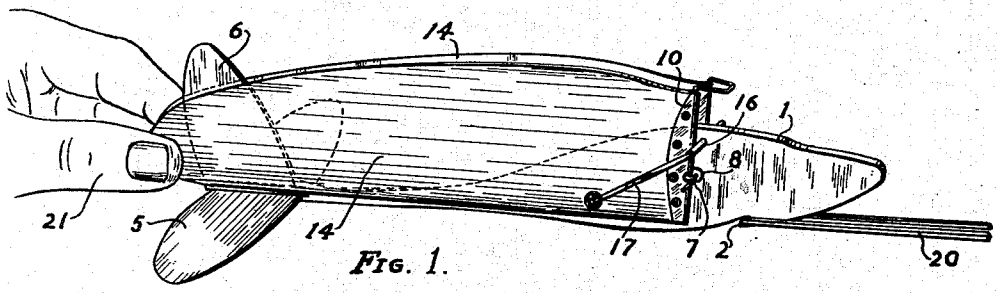


FIG. 1.

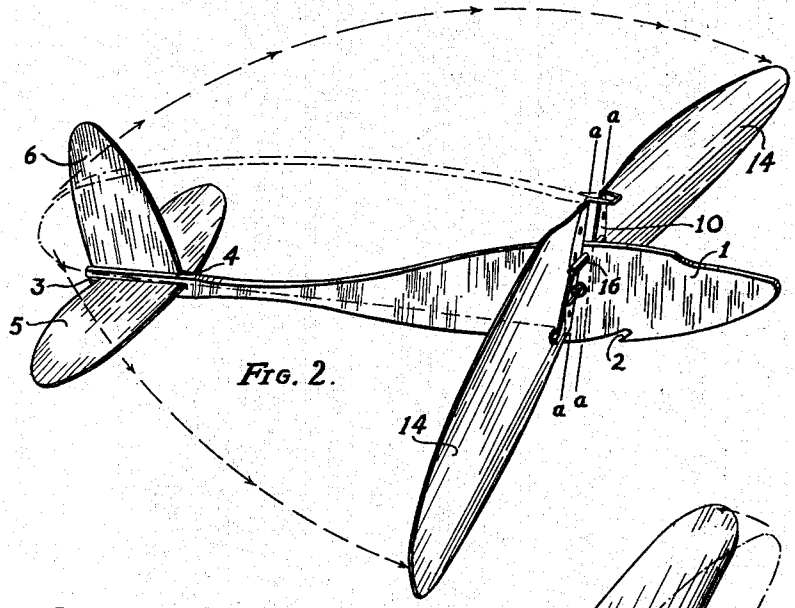


FIG. 2.

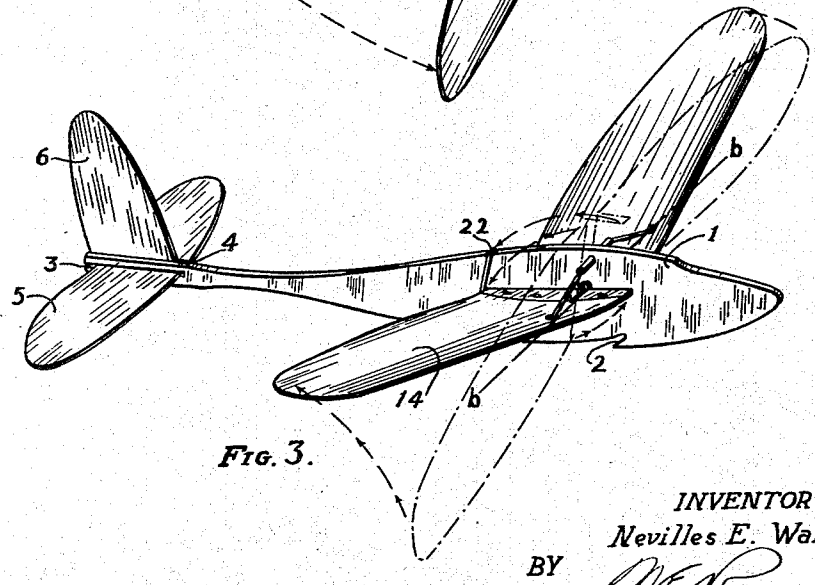


FIG. 3.

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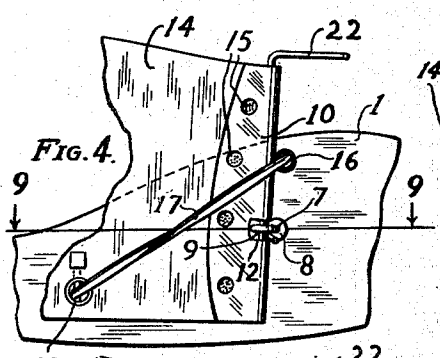


FIG. 4.

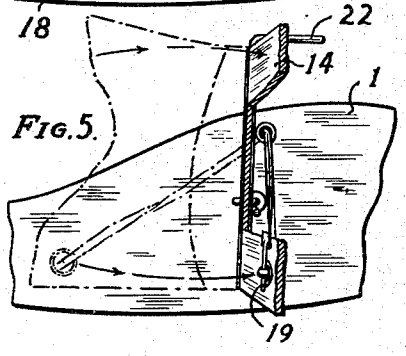


FIG. 5.

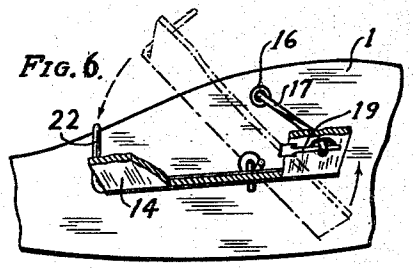


FIG. 6.

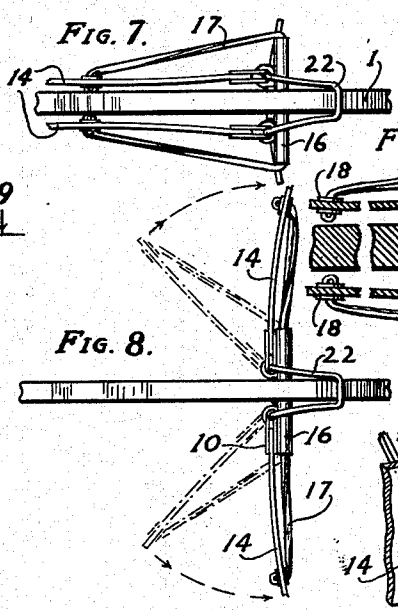


FIG. 7.

FIG. 8.

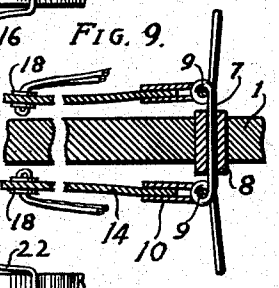


FIG. 9.

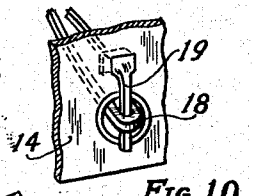


FIG. 10.

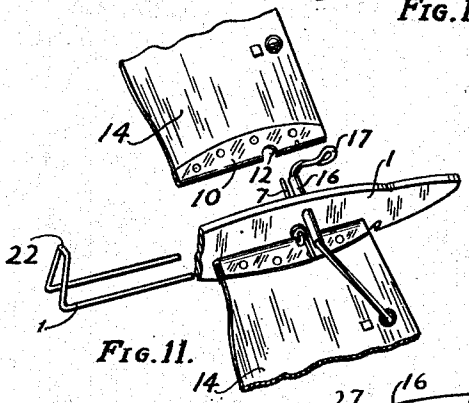


FIG. 11.

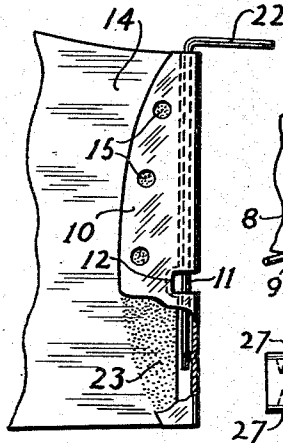


FIG. 12.

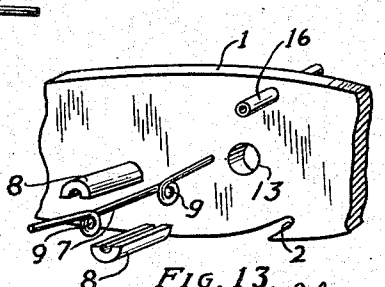


FIG. 13.

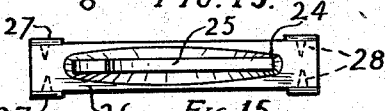


FIG. 15

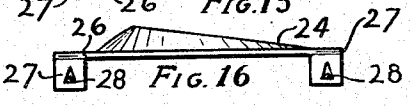


FIG. 16

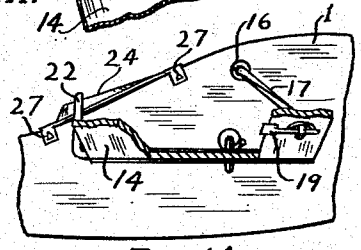


FIG. 14

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UNITED STATES PATENT OFFICE

2,221,012

TOY GLIDER

Nevilles E. Walker, Portland, Oreg.

Application October 13, 1939, Serial No. 299,305

20 Claims. (Cl. 46—80)

My invention relates to toys, and it relates more particularly to toy gliders of the type adapted to soar automatically after being thrown into the air as darts. To function as a dart, an object must be streamlined, that is, it must present a contour having little resistance to its passage through air. It should be an elongated body having no protuberances. On the other hand, to soar successfully a glider must have as large a wing area as possible in proportion to its weight. A glider will not serve as a dart, and a dart will not soar, but if an object in the form of a dart can be thrown high into the air and there made to change its form into that of a glider, it will provide amusement by soaring for a surprisingly long time.

The principles to be observed in building a glider that will soar automatically are well known, and my present invention is not concerned therewith. An object of my invention, however, is to provide a glider constructed in accordance with said principles whose wings may be folded back during its upward flight as a dart, said wings automatically assuming their open positions when the speed of the glider with respect to the air decreases below a predetermined value. The manner in which said wings open is of paramount importance.

I have found that, to function as a dart, the wings of a glider should be folded back so that they lie in a vertical plane, alongside the body. But to function as a glider, said wings must swing outward substantially perpendicular to said body, and they must also rotate into a horizontal plane. Thus, two axes of rotation must be provided for each of said wings, one vertical axis at the end of the wing, and a horizontal axis perpendicular to the body. For reasons hereinafter discussed, I prefer that said wings shall complete their rotation about their vertical axes before beginning to rotate about their horizontal axes. To this end, I provide a member under tension, such as a rubber band, adapted to cause said wings to unfold and I provide a stop to prevent rotation of said wings about the aforesaid horizontal axis while they are unfolding. However, at the end of said unfolding operation, due to the arrangement of said axes and said rubber band, said rubber band tends to rotate the wings in the opposite direction, away from said stop, and the wings thus rotate through substantially 90° into their horizontal position. Thus, in unfolding, the wings remain in a vertical plane while swinging outwardly from the body. Then they rotate into the horizontal plane, assuming the ordinary position of airplane wings.

It will be apparent that the aforesaid unfolding of said wings while in a vertical plane will tend to check the forward movement of the glider. This is a desirable result for reasons involving aeronautical principles not herein important. Suffice it to say that said checking of the forward movement of a glider at the time it changes from a dart to a glider causes it to begin to soar more quickly and with more certainty. It will be understood that said checking of the forward movement of the glider does not occur until said forward movement has almost ceased of its own accord.

The principal object of my invention is to provide a glider whose wings are adapted to open from their folded position when its velocity through the air decreases below a predetermined value low enough that said glider will have reached nearly its maximum height as a dart.

A further object of my invention is to provide a glider whose wings remain in a vertical plane while opening to check its forward motion, thereafter rotating into a horizontal plane.

A further object of my invention is to provide a single tension member adapted to, first, open the wings of a glider away from the rear portion of the body thereof to a position slightly forward of perpendicular to said body, then, rotate said wings into substantially horizontal planes forming a predetermined dihedral angle with each other.

A further object of my invention is to provide a glider having a substantial wing area, and that is light in weight. I prefer to make said glider of balsa wood, and I further reduce its weight by avoiding the use of unnecessary parts in its construction, making one part serve two purposes in some cases.

A further object of my invention is to provide a dart type glider that may be built cheaply. I achieve said object, in one respect, by constructing said glider of parts which may be quickly and easily assembled.

A further object of my invention is to provide a glider that although light in weight, is sufficiently strong so that it may be gripped in the hand to apply tension to a resilient member which, when released, will propel said glider high into the air.

Other objects and advantages of my invention will be described with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a toy glider embodying my invention, said glider being shown folded in position to be released to be propelled by a rubber band;

Fig. 2 is a perspective view of said glider in a partially unfolded condition;

Fig. 3 is a perspective view of said glider in its gliding position;

Fig. 4 is a fragmentary side elevation of said glider with its wings in their folded position;

Fig. 5 is a view similar to Fig. 4 but with said wings shown rotated forward about their vertical axes;

Fig. 6 is a view similar to Fig. 5 but with said wings shown rotated about their horizontal axis;

Fig. 7 is a fragmentary plan view of said glider with its wings in their folded position.

Fig. 8 is a view similar to Fig. 7 but with said wings shown rotated forward about their vertical axes, said wings being shown in an intermediate position by dot-and-dash lines;

Fig. 9 is a foreshortened sectional view taken on the line 9—9 in Fig. 4;

Fig. 10 is an enlarged detail view of means for fastening a rubber band to the wings of said glider;

Fig. 11 is a fragmentary perspective view of said glider, some of the parts thereof being shown separated to illustrate the mode of their assembly;

Fig. 12 is an enlarged fragmentary detail view of the hinge member at the end of one of the wings of said glider, showing the manner of securing the same to said wing, together with a pintle therefor, and showing the way the said pintle is held in place;

Fig. 13 is a fragmentary perspective view showing how a formed pivot member may be assembled in journal bearings in the body of said glider;

Fig. 14 is a view similar to Fig. 6 of a modification of my invention showing a movable wedge for adjusting the angle of incidence of the wings when the latter are unfolded;

Fig. 15 is a plan detail view of said wedge; and

Fig. 16 is a side elevation of the wedge shown in Fig. 15.

A toy glider embodying my invention comprises a body 1 having a notch 2 near its forward end and a horizontal slot 3 and a vertical slot 4 for holding tail members 5 and 6, respectively, at the rear end of said body. I prefer to make said body and said tail members of balsa wood, and to hold said parts together by frictional engagement of said tail members in said slots.

Somewhat forward of the middle of said body, a pivot member 7 is journaled in split bearing 8, preferably made of hard wood or metal. I prefer to form eyes 9 in said pivot member for engaging hinge members 10, pintle 11 being adapted to pass through said eyes when the latter have been inserted in notches 12 in said hinge members. I have found it peculiarly advantageous to provide a split bearing for said pivot member somewhat larger in diameter than the eyes therein. The hole 13 for said bearing will then be of sufficient diameter to permit one of said eyes to pass therethrough. Said bearing may be assembled on said pivot, and both may then be inserted in said hole 13 in body 1, said bearing being glued in said hole, if desired. This constitutes a simple and cheap method and means for mounting said pivot member, a matter of considerable importance in toys which must be sold at a low price.

Hinge members 10 are U-shaped, adapted to clasp wing members 14 and to hold the same securely, preferably with the aid of glue 23. I have found that holes 15 perforating said hinge members greatly increase the strength of the glued joint with said wings, and this is a matter of considerable importance inasmuch as a force of as much as twenty-five pounds may be exerted on said wings in launching the glider by the method which I prefer, and which is hereinafter described.

Having described means whereby the wings of a toy glider may be mounted to rotate about both a vertical and a horizontal axis, I will now describe the means which I prefer to motivate said rotation. I wish said wings to remain folded backward as they are shown in Fig. 1, throughout the upward flight of the glider. The natural tendency of said wings is to remain in this position during said flight due to the pressure of the air on their outer surfaces, a partial vacuum being formed between said wings by their motion through the air. As said motion diminishes, the aforesaid force tending to hold said wings folded also diminishes, and when it diminishes below a certain predetermined value, I desire to have said wings unfold. In other words, when said glider has traveled upward as a dart substantially as far as it will go, I desire it to change into a glider. This will be accomplished if the aforesaid motivating means for rotating said wings is adapted to exert a small force tending to unfold said wings during its upward flight, said small force being sufficient to move said wings when their speed through the air diminishes below said predetermined value. Thereafter, said motivating means should have other operating characteristics hereinafter discussed.

Tube 16, which I prefer to make of thin brass or wood, may be press fitted in body 1 somewhat above and slightly forward of pivot member 7. Said tube should be of sufficient length so that it projects outward from said body a substantial distance on each side. A rubber band 17 may be inserted in said tube, and each end of said rubber band, for example, may be fastened to one of said wings by passing the looped end of said band through an eyelet 18 and looping the same over clip 19 staked in said wing, as is shown clearly in Fig. 10. Any other method of fastening may be used as by securing a hook or other device to the wing as may suggest itself to a mechanic skilled in the art. Said rubber band should be of suitable length to be under a substantial tension when said ends are so fastened.

As may be seen with reference to Fig. 1, due to the length of tube 16 said rubber band provides a torque tending to rotate said wings about pintle member 11, that is, about the axes *a—a* in Fig. 2. After the velocity of the glider diminishes to the point where said torque becomes effective to produce rotation of said wings about axes *a—a*, it will be apparent that the lever arm on which said rubber band exerts force to produce said torque will have increased by virtue of said wings having unfolded slightly. In other words, the aforesaid torque will increase, as the wings begin to unfold, due to the increased lever arm, and this assures rapid opening of the wings with only a moderate starting torque which allows the glider to nearly stop before the wings start to open. It will be seen that this rapid opening of said wings, from the position shown in Fig. 1 to that shown in Fig. 2, will result in a sudden checking of the motion of the glider at the end of its upward flight, and this checking results in a prompt change from dart to glider action.

As viewed in Fig. 4, the tension in said rubber band will produce a clockwise torque about the axis of pivot 7, holding hinge member 10 against tube 16 which acts as a stop to prevent rotation of wing 14 about its horizontal axis. The wing

is thus held clear of the tail structure so that it is free to unfold. However, as said wing rotates about its vertical axis, unfolding to the position shown in Fig. 5, the lever arm of said rubber band moves to the opposite side of said axis of pivot 7 and said rubber band produces a counterclockwise torque that rotates said wing about axis *b*—*b* away from tube 16 into the horizontal position shown in Fig. 6, this being also the gliding position shown in Fig. 3.

I prefer to launch the glider embodying my invention by means of a rather heavy rubber band 20 hooked in notch 2, which may be held by any suitable means such as the hand of the operator (not shown) while being stretched by hand 21 shown in Fig. 1. The body of said glider should be pointed upward almost vertically as said rubber band is stretched and then released by hand 21. Said glider will then travel upward as a dart until its velocity diminishes to a predetermined value that will permit rubber band 17 to rotate wings 14 about their vertical axes until stopped by tube 16, thus checking said upward movement. As said wings complete their rotation about their vertical axes, they rotate about their horizontal axis into the horizontal plane, which is their gliding position. I have found that said glider will begin to function as a glider more promptly and with more certainty if its velocity is thus checked by causing said wings to rotate first about their vertical axes, and then about their horizontal axis.

Pintle 11 may be made U-shaped, each leg serving as a pintle for one wing. The loop end of said pintle may then be bent substantially at right angles to form a saddle member 22 adapted to straddle body 1 when said wings rotate about their horizontal axis and thus to serve as a stop for said rotation. Thus, the length of said saddle will determine the angle of incidence of said wings. It will be understood that this angle, together with other design features of the glider such as the dihedral angle of the wings and their camber, will be properly chosen to assure automatic gliding.

In order to adjust the angle of incidence of the wings, wedge 24 may be moved along body 1 thereby to vary the position in which saddle member 22 comes to rest. Said wedge may be embossed to form a face 25 inclined with respect to its base 26. Tabs 27 may be formed along said base, and barbs 28 may be formed thereon. Said wedge should preferably be made of relatively thin metal so that said tabs may readily be bent inward to cause said barbs to engage the body, or outward to disengage the same. Thus, the wedge may be moved along body 1 by disengaging it, and then bending tabs 27 inward to re-engage it.

The purpose of the aforesaid movable wedge is to enable the user to properly adjust the wings to cause the glider to glide for the maximum time possible. Toy gliders must be manufactured cheaply, and considerable tolerance in size and weight of the various parts is desirable. In this respect, the problem is like that encountered in manufacturing toy airplanes. In the latter, however, it is possible to compensate for variations in size and weight by moving the wings backward or forward on the body, said wings ordinarily being held in slots in said body. The plane may thus be nicely balanced. But in a glider whose wings are pivotally mounted it is not feasible to move the wings longitudinally of the body. I, therefore, provide means for varying the angle of incidence of said wings thereby to achieve a similar result. I find that this adjustable feature is useful, furthermore, to compensate for warping of the wings, or other parts, after the glider is in use, as well as to compensate for variations in manufacture.

I claim:

1. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, and an elongated tubular member extending laterally through said body, said means extending therethrough.

2. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, and an elongated tubular member extending laterally through said body, said means extending therethrough, the ends of said tubular member extending laterally from said body to points further from said body than do the wing hinge pintles.

3. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, and an elongated tubular member extending laterally through said body, said means extending therethrough, said tubular member being aligned with and abutting against the hinged ends of said wing elements when the latter are folded flatwise against said body.

4. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, a formed pivot member secured to said wing ele-

ments, and a journal bearing extending transversely of said body, said pivot member being journaled therein.

5. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, an elongated tubular member extending laterally through said body, said means extending therethrough, a formed pivot member secured to said wing elements, and a journaled bearing extending transversely of said body, said pivot member being journaled therein, said journal bearing being arranged rearwardly of said tubular member, whereby when said wing elements are pulled from a position flatwise against said body to a position approximately normal thereto by said pulling means, said wings will tend to be rotated by said latter means about an axis extending through said pivot member.

6. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said w'ng elements to a position away from the sides of said body and generally normal thereto, an elongated tubular member extending laterally through said body, said means extending therethrough, a formed pivot member secured to said wing elements, and a journal bearing extending transversely of said body, said pivot member being journaled therein, said journal bearing being arranged below said tubular member, whereby when said wing elements are pulled from a position flatwise against said body to a position approximately normal thereto by said pulling means, said wings will tend to be rotated by said latter means about an axis extending through said pivot member.

7. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, an elongated tubular member extending laterally through said body, said means extending therethrough, a formed pivot member secured to said wing elements, and a journal bearing extending transversely of said body, said pivot member being journaled therein, said journal bearing being arranged rearwardly of and below said tubular member, whereby when said wing elements are pulled from a position flatwise against said body to a position approximately normal thereto by said latter means about an axis extending through said pivot member.

8. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, an elongated tubular member extending laterally through said body, said means extending therethrough, and detachable securing means for said pulling means, said tubular member being arranged rearwardly thereof when said wing elements are extended in gliding position.

9. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, an elongated tubular member extending laterally through said body, said means extending therethrough, and detachable securing means adjacent the leading edge of said wing elements for said pulling means, said tubular member being arranged rearwardly thereof when said wing elements are extended in gliding position.

10. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said body being flat and said wings being adapted to be folded flatwise against the flat sides of the vertical tail structure member and above the horizontal member thereof, means joining said wing elements adjacent but spaced from their pivotal connections, respectively, with the body and positioned and arranged to tend to pull said wing elements to a position away from the sides of said body and generally normal thereto, an elongated tubular member extending laterally through said body, said means extending therethrough, the ends of said tubular member extending laterally from said body to points further from said body than do the wing hinge pintles, said tubular member being alined with and abutting against the hinged ends of said wing elements when the latter are folded flatwise against said body, a formed pivot member secured to said wing elements, a journal bearing extending transversely of said body, said pivot member being journaled therein, said journal bearing being arranged rearwardly of and below said tubular member, whereby when said wing elements are pulled from a position flatwise against said body to a position approximately normal thereto by said pulling means, said wings will tend to be rotated by said latter means about

an axis extending through said pivot member; and detachable securing means adjacent the leading edge of said wing elements for said pulling means, said tubular member being arranged rearwardly thereof when said wing elements are extended in gliding position.

11. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, a pintle member, and a formed pivot member journaled in said body and having eyes extending into the notches in the wing hinges and alined with the pintle recesses, respectively.

12. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, a pintle member, and a formed pivot member journaled in said body and having eyes extending into the notches in the wing hinges and alined with the pintle recesses, respectively, the ends of said pivot member overlying and abutting with the hinge members, respectively, when the wings are extended in gliding position.

13. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, a pintle member, a formed pivot member journaled in said body and having eyes extending into the notches in the wing hinges and alined with the pintle recesses, respectively, and constrictions in said hinge recesses adapted frictionally to engage and hold the pintle member when the latter is inserted in said recess.

14. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, and a pintle member, said pintle member being provided with a laterally off-set saddle member arranged centrally thereof to overlie and engage the body when the wings are arranged in gliding position.

15. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, and a pintle member, said hinge member being secured to said end of said wing by glue.

16. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a perforated U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, and a pintle member, said hinge member being secured to said end of said wing by glue in said perforations.

17. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, and a U-shaped pintle member.

18. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, a pintle member, and a formed pivot member journaled intermediate the ends thereof in said body and having eyes extending into the notches in the wing hinges and alined with the pintle recesses, respectively.

19. A retractable wing toy glider comprising an elongated body and a pair of wing elements pivotally secured to said body, means for detachably securing an element to the forward end of said body for launching said glider, a perforated U-shaped hinge member secured about the inner end of each of said wing elements, said hinge member being recessed to receive a pintle member, a U-shaped pintle member, a formed pivot member journaled intermediate the ends thereof in said body and having eyes extending into the notches in the wing hinges and alined with the pintle recesses, respectively, the ends of said pivot member overlying and abutting with the hinge members, respectively, when the wings are extended in gliding position, and constrictions in said hinge recesses adapted frictionally to engage and hold the pintle member when the latter is inserted in said recess, said pintle being provided with a laterally offset saddle member arranged centrally thereof to overlie and engage the body when the wings are arranged in gliding position, said hinge member being secured to said end of said wing by glue in said perforations.

20. A retractable wing toy glider comprising an elongated body having a tail structure comprising vertical and horizontal members, a pair of wing elements pivotally secured to said body, said wings in one position being adapted to be folded flatwise against the sides of said body, means joining said wing elements tending to hold the latter away from said body and generally normal thereto, a saddle member joining said wing elements, arranged intermediate the latter and adapted to overlie and engage the body when the wings are arranged normal to said body, and means carried by said body adapted to engage said saddle member and to adjust the position of said wings when the latter are arranged generally normal to said body.

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