Sept. 9, 1958 H. M. HENNEBERRY 2,850,838

FLYING TOY

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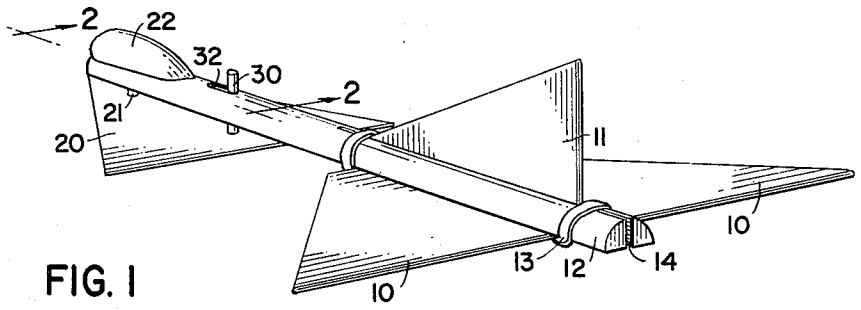


FIG. 1

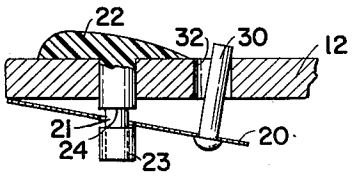


FIG. 2

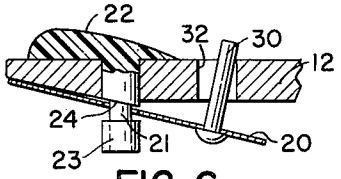


FIG. 6

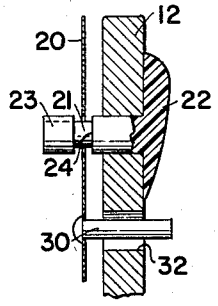


FIG. 3

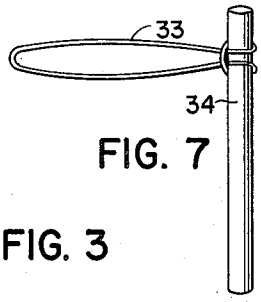


FIG. 7

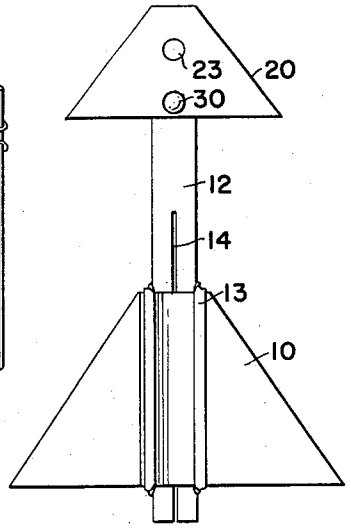


FIG. 4

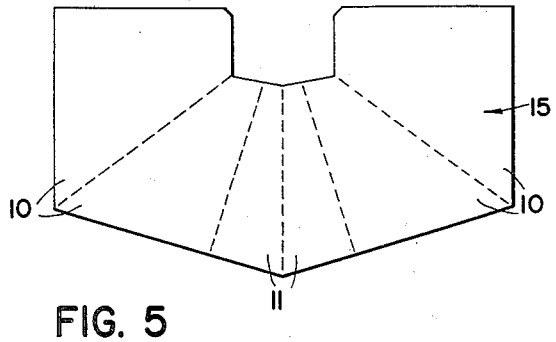


FIG. 5

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FLYING TOY

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7 Claims. (Cl. 46—81)

This invention relates to a flying toy and is particularly applicable to a toy of the type which is intended to be launched dart-like to a substantial height and to assume, at such height, the characteristics of a sailplane whereby it will soar and glide in flights of long duration and range.

Ideally, devices of this type should in their initial or launching phase act as a dart or arrow and in their final or soaring phase should be provided with inclined elevator surfaces establishing those conditions of dynamic longitudinal stability necessary to soaring flight.

This obvious ideal has led to the provision of toys having airfoils which are responsive to drag or inertia so that the airfoils are folded or inclined at zero angle of attack at least during the preliminary portion of the launching phase. These devices, however, are impositive in operation, depending as they do on sensitivity to small pressure and force differences. Moreover, their principle of operation is such as to inherently limit maximum height because those conditions of force and pressure which obtain in soaring flight also obtain as the full height of launching (dart-like) flight is approached, causing responsive self-adjustment of the device to occur prematurely.

Other devices have been provided which are intended to fulfill the obvious object of converting from dart-like flight to soaring flight. These devices are essentially timers which are designed to effect self-adjustment. The mode of timing in these devices is neither constant nor positive. It is only by coincidence that self-adjustment may occur at the optimum moment in any given flight.

Still other devices have been provided in which self-adjustment from dart-like to gliding flight is accomplished by movement of airfoil surfaces by actuation of weights. Unfortunately, these devices have had to employ motion-reversing linkages in order to attain the necessary negative angle of attack of the stabilizer, for if the leading end of the stabilizer was directly weighted to achieve the necessary angle of attack for soaring flight, then the stabilizer lacked stability in launching flight and could not maintain zero angle of attack in launching flight.

The purpose of my invention is to attain the obvious object of converting from dart-like free flight to soaring or gliding flight by extremely simple means which is positive and foolproof in operation. My invention assures that conversion will not occur prior to the time that launching momentum is fully exhausted.

A more general object of my invention is to provide a toy glider of improved performance and simple construction which will be an inexpensive, enjoyable and instructive plaything.

I attain these objects by providing a forwardly located stabilizer or wing which is weighted in such a manner as to shift angle of attack at the termination of launching flight and at the same time to maintain stability under both launching and gliding conditions. I provide a weight-actuated type of self-adjusting control but at the same time avoid altogether the provision of any motion-reversing linkage. The weight I provide aids in maintaining stability during both phases of flight.

The mode of operation of my invention is more fully described below in connection with a description, by way of example, of a presently preferred embodiment of the device.

In the accompanying drawings, Figure 1 is a perspective view of an embodiment of the invention in an attitude of gliding or soaring flight. Figure 2 is a fragmentary vertical sectional view taken on line 2—2 in Figure 1. Figure 3 is a view similar to Figure 2 but showing the relation of the parts during launching flight. Figure 4 is a bottom view of the embodiment shown in Figure 1. Figure 5 is a layout of the web which is folded to make up the wing and fin surfaces. Figure 6 is a fragmentary vertical sectional view of an alternate arrangement designed to avoid inverted flight, as will be described later. Figure 7 is a perspective view of a more or less conventional launching device.

A wing **10** and fin **11** are attached to a fuselage **12** by some suitable means such as a rubber band **13**. The fuselage may be half-round balsa and may be slotted as at **14**. The wing and fin may comprise the single web **15** shown in Figure 5, the web being folded on the fold lines indicated by dotted lines. When the web is properly folded, the fin portion **11** is inserted through the slot **14** and the assembly held together by the rubber band **13**. The wing and fin assembly is readily adjustable along the slotted length of the fuselage.

A canard-type stabilizer **20** is provided which is loosely and pivotally received on a stem **21** affixed to the forward end of the fuselage. The stem **21** can conveniently be integral with a decorative canopy piece **22**, projecting through a hole in the fuselage. A collar **23** is pressed over the end of the stem **21** to retain the canard surface and to limit its movement in conjunction with the shoulder **24** on the stem **21**.

A weight **30** is fixed to the canard surface **20** aft of the stem **21**. The weight may have the form of a stud bolt, the shank of which is loosely received in a short longitudinally extending slot **32** formed in the fuselage. The canard surface and weight **30** together constitute a stabilizer assembly capable of vertical pivoting and with a center of gravity located aft of the pivot point. The location of this center of gravity assures proper functioning of the canard surface, as will be explained below. The weight **30** in the illustrated embodiment also engages the sides of the slot **32** to serve as a guide so that the canard surface cannot swing laterally out of line with the fuselage. Thus, although the pivotal mounting of the canard surface on the stem **20** does not of itself limit the canard surface only to vertical pivoting with respect to the fuselage, the canard is so limited by the engagement of the shank of the weight **30** with the slot **32**. The effect is that the canard surface may pivot vertically with respect to the fuselage around a pivot point (or, more accurately, around a plurality of pivot points which lie within a small locus) in the vicinity of the stem **21**.

In Figure 3, which represents the ascent or launching phase, when the characteristics of a dart are to be achieved, the direction of flight will be vertical or nearly vertical. The stabilizer assembly has a zero moment or a very small moment around the pivot point locus of the canard surface. Accordingly, the canard surface is maintained substantially parallel to the fuselage at zero angle of incidence. Thus, upward flight of the device will resemble the flight of an arrow or a dart at all times until maximum height is attained.

At maximum height, the device will fall away from vertical position. It will stabilize in the position shown in Figure 1. The stabilizer assembly now has a sub-

stantial moment around the pivot point locus of the canard surface. The action of gravity on the stabilizer assembly will now insure that the canard surface will lie at a positive angle of attack. Since the angle of attack of the main wing **10** is less than the angle of attack of the canard surface, there will be achieved and maintained a condition of dynamic longitudinal stability, and stable soaring or gliding flight will result.

The launching device illustrated in Figure 7 may consist of a suitable elastic, such as a rubber band **33**, and a stick or handle, such as dowel **34**. The collar **23** together with stem **21** can provide a convenient launching pin to receive elastic **33** for the purpose of propelling the glider into the air in a more or less conventional manner.

The arrangement illustrated in Figure 2 can, in some designs, result in stable soaring flight in an inverted position. Should the glider arrive at an inverted position at the termination of the ascent phase of the flight, the stabilizer assembly will have a substantial moment around the pivot point just as it has in the normal flight position, and if the dimensions of the design are such as to allow a substantial angle of attack on the canard surface in this position, stable inverted flight may be encountered. This can be avoided by the arrangement illustrated in Figure 6. In this alternate design, the shoulder **24** is inclined and the fuselage **12** is relieved to receive the canard surface at an angle of attack suitable for soaring flight in a normal position. Because the shoulder **24** projects little or not at all beyond the bottom of the fuselage, only zero or negligible angle of attack of the canard surface is possible in an inverted position, and thus, stable soaring inverted flight will not be encountered. With this arrangement, if the glider should arrive at an inverted position after the ascent, it will dive briefly and then stabilize in normal soaring flight. The inclination of the shoulder **24** also serves to restrict the locus of pivot points and thus may establish more consistant operation of the pivoting canard surface.

Some of the precise details of the above described example of the invention are not critical to the invention. Accordingly, the invention is not limited to the precise details of the disclosed example. The scope of the invention is defined in the following claims.

What is claimed is:

1. In a toy airplane, a fuselage having nose and tail portions, a flight-supporting wing fastened to said fuselage, a stabilizer assembly associated with said fuselage and located between the nose of said fuselage and said supporting wing, said stabilizer assembly being mounted for vertical pivoting movement with respect to said fuselage about a given locus, and means limiting said pivoting movement, the center of gravity of said stabilizer assembly being rearward of said given locus.

2. A flying toy comprising a fuselage, flight-supporting wings associated with said fuselage, the forward wing assembly being mounted for vertical pivoting movement with respect to said fuselage about a given locus, means for limiting said pivoting movement, the center of gravity of said forward wing assembly being rearward of said given locus.

3. A flying toy comprising a fuselage, a flight-supporting wing fastened to said fuselage, a stabilizer assembly associated with said fuselage forwardly of said supporting wing, said stabilizer assembly being mounted for vertical pivoting movement with respect to said fuselage about a given locus, the center of gravity of said stabilizer assembly being rearward of said given locus.

4. A flying toy comprising a fuselage, a flight-supporting wing fastened to said fuselage, a stabilizer associated with said fuselage forwardly of said supporting wing, a stem protruding from said fuselage, said stabilizer loosely receiving said stem, a head on said stem to retain said stabilizer thereon, a longitudinally extending short slot in said fuselage rearwardly of said stem, a relatively heavy element fixed to said stabilizer rearwardly of said stem, said element having a shank extending into said slot, the parts being proportioned so that said shank engages the end of said slot to limit vertical swinging movement of said stabilizer away from said fuselage and engages the sides of said slot to minimize transverse swinging movement of said stabilizer with respect to said fuselage.

5. A flying toy comprising a fuselage, a flight-supporting wing fastened to said fuselage, a stabilizer assembly associated with said fuselage forwardly of said supporting wing, a stem protruding from said fuselage, said stabilizer assembly loosely receiving said stem, a head on said stem to retain said stabilizer assembly thereon, and a shoulder on said stem to limit vertical movement of said stabilizer assembly in conjunction with said head, the center of gravity of said stabilizer assembly being rearward of said stem.

6. A flying toy comprising a fuselage, a flight-supporting wing fastened to said fuselage, a stabilizer assembly associated with said fuselage forwardly of said supporting wing, a stem protruding from said fuselage, said stabilizer assembly loosely receiving said stem, a head on said stem to retain said stabilizer assembly thereon, said stem and said head comprising also a launching pin to receive an elastic band for the purpose of propelling the toy into the air, the center of gravity of said stabilizer assembly being rearward of said stem.

7. A flying toy comprising a fuselage, a flight-supporting wing fastened to said fuselage, a stabilizer assembly associated with said fuselage forwardly of said supporting wing, a stem protruding from said fuselage, said stabilizer assembly loosely receiving said stem, a head on said stem to retain said stabilizer assembly thereon, a shoulder on said stem inclined at an upward angle, said fuselage being relieved on the bottom to receive the forward portion of said stabilizer assembly, said shoulder and said fuselage being proportioned to limit angle of attack of said stabilizer assembly when the toy is in an inverted position to a negligible value while allowing large angle of attack of said stabilizer assembly when the toy is in a normal soaring position, the center of gravity of said stabilizer assembly being rearward of said stem.

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