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[54] AERIAL TOY

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[52] **U.S. Cl.** ..... **46/74 D,** 273/95 A

[51] **Int. Cl.** **A63h 27/00**

[58] **Field of Search** ..... 46/47, 50, 74 R, 74 B; 273/95 A, 99

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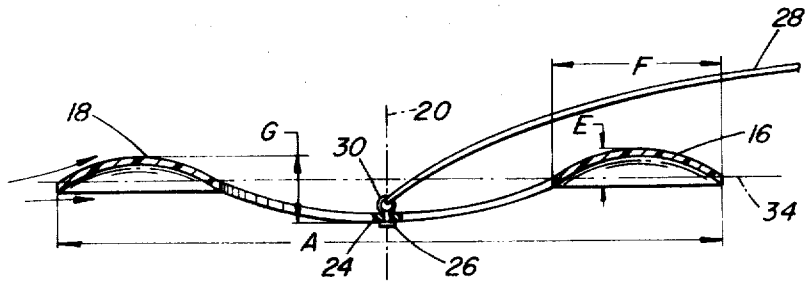
[57] **ABSTRACT**

An aerial toy comprising a disc-like body having aerodynamically shaped surfaces adapted to be rotated about a center axis to which is connected an elongated elastic tether. The surfaces are shaped so as to provide lift during rotation about the axis and during lateral movement through the air in a direction perpendicular to the axis whereby the free end of the tether can be held and the disc thrown for flight away from and back to the user.

14 Claims, 8 Drawing Figures



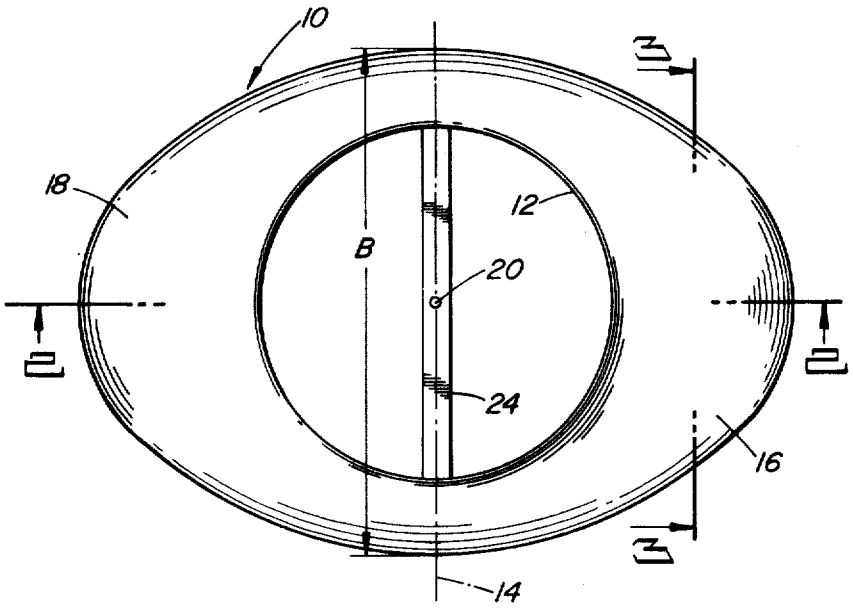


Fig 1

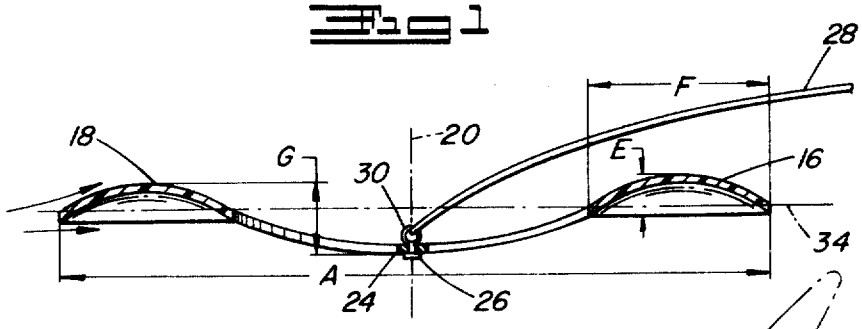


Fig 2

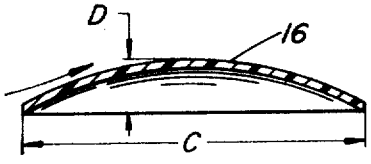


Fig 3

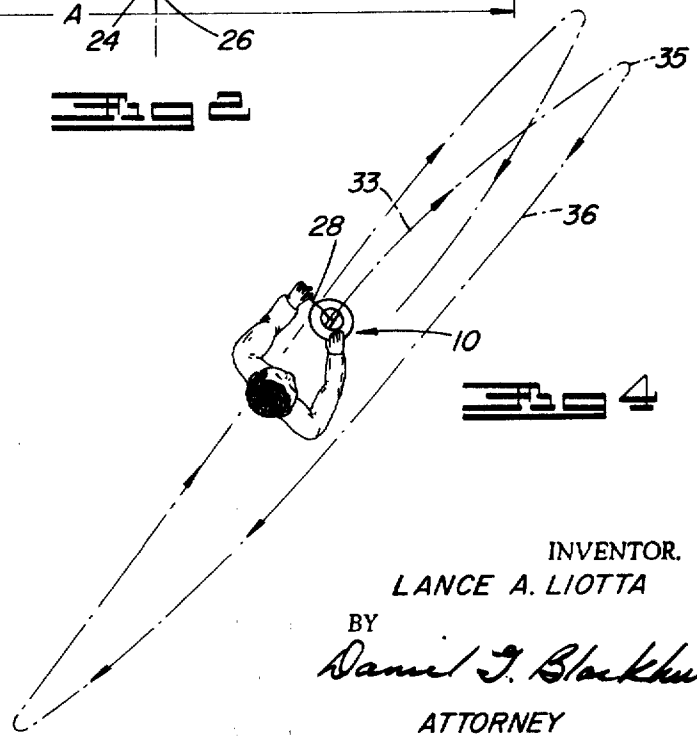


Fig 4

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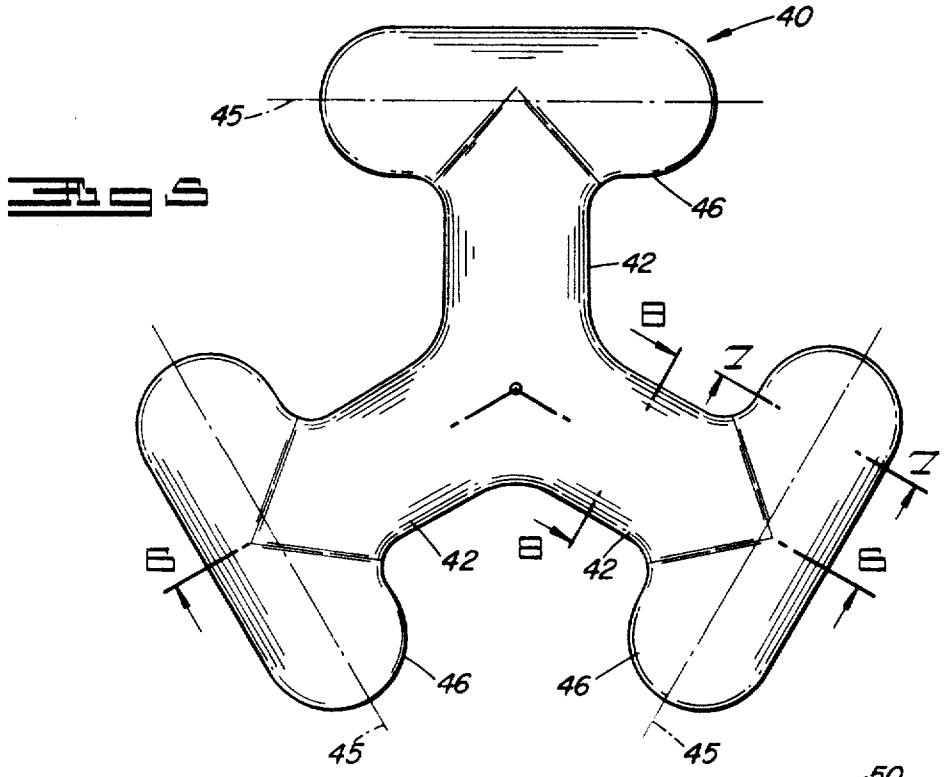

Fig 5

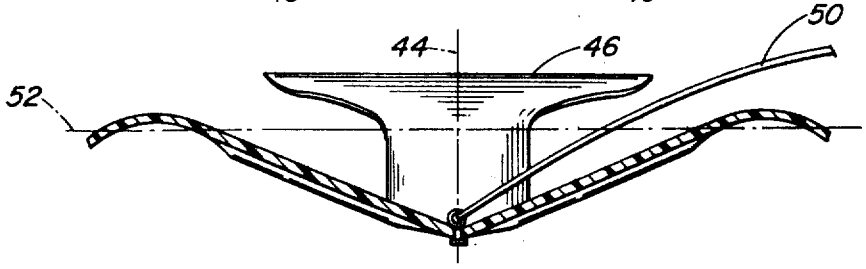

Fig 6

Fig 8

Fig 7

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AERIAL TOY

The present invention is directed to the toy art and, more particularly, to an improved tethered-type aerial toy.

Various saucer or disc-type aerial toys are well known. Normally, they are thrown generally horizontally with a spinning motion and have a drifting or somewhat floating flight path. The path of flight is affected by the manner in which the disc is oriented when thrown, and the direction of the prevailing wind or air currents. Although the discs can be thrown in a manner to cause them to curve substantially during flight, only in rare instances is it possible to have the discs return to the thrower.

The subject invention provides a disc-like aerial toy which can be thrown or used for playing catch like a standard disc-type toy. Preferably however, it is tethered on an elastic band so that it returns to the thrower. The toy has aerodynamic characteristics such that even when tethered, it retains its generally horizontal orientation during flight away from the thrower, as well as, during return.

The toy formed in accordance with the invention has the characteristic such that when once thrown with a substantial spin, it can make repeated passes past the thrower. The toy flies with full aerodynamic stability to opposite sides of the thrower to the full extent permitted by the elastic band. The total flight time depends to a large extent upon the amount of spin originally imparted to the disc; however, flights of a duration of up to one minute are entirely possible.

In accordance with the preferred embodiment of the invention, the aerial toy comprises a generally disc-like body having upper and lower surfaces which define air foil surfaces adapted to provide lift both during rotation of the disc about a central axis generally perpendicular to the plane of rotation, as well as during translation of the body through the air in a direction generally perpendicular to the axis of rotation. Connected over the upper surface of the body at a point generally on the axis and somewhat at or below the general plane of rotation is an elongated tether at least a portion of which is capable of substantial elastic elongation.

In using the toy, the free end of the tether is held in one hand and the body is held in the manner of a standard flying saucer disc and thrown with a snap of the wrist to impart substantial spin to the body. The combination of the air foil surfaces produces lift which maintains the disc elevated during motion through the air. The normal gyroscopic action of the body spinning about its central axis maintains the body on stable flight as it stretches the tether. When the force of the tether is sufficient to overcome the motion of the disc in the translatory direction, the disc is returned under the influence of the elastic tether in a direction generally toward the user. At the point where the disc has stopped moving in the thrown direction and begins moving in the reverse direction, the lift surfaces which produce lift during rotation maintain the disc stable and generally level until, on the return under the influence of the elastic tether, the other lift surfaces combine to add further lift. As can be appreciated, if sufficient spin is imparted to the body, the body can make several passes away from and back to the thrower. At all times, the disc maintains generally stable, horizontal flight.

The advantages of this type of aerial toy are obvious. For example, the toy can be thrown at a target after which it will return in stable flight to the thrower. Alternately, the device can be used like an aerial yo-yo and merely thrown and allowed to pass beyond the thrower on its return flight after which it will return back past the thrower in generally the original thrown direction.

The primary reason for the stable flight is the inherent gyroscopic action plus the combination of lift surfaces producing lift components at right angles to one another to provide lift both because of rotation and because of horizontal translation through the air. This, together with the attachment of the tether at a point preferably on the axis of rotation but beneath the general plane of rotation, produces an extremely stable flight path throughout the motion of the disc.

Accordingly, a primary object of the invention is the provision of a tethered aerial toy which maintains stable flight characteristics throughout several reversals of flight direction.

Yet another object is the provision of an aerial toy which has unusual aerodynamic characteristics and produces an extremely unusual flight path.

A further object of the invention is the provision of a toy of the type described which can be flown with substantial stability in many directions.

Yet another object is the provision of a toy of the type described which is extremely simple to use and can be manufactured relatively inexpensively.

These and other objects and advantages will become apparent from the following description when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a plan view of the preferred embodiment of an aerial toy formed in accordance with the preferred embodiment of the invention;

FIG. 2 is a cross-sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a plan view of a disc of the type shown in FIG. 1 being used with the dotted line showing a typical repetitive flight path;

FIG. 5 is a plan view of a second embodiment of aerial toy formed in accordance with the invention;

FIG. 6 is a cross-sectional view taken on line 6—6 of FIG. 1 showing the air foil surfaces; and,

FIGS. 7 and 8 are cross-sectional views taken on line 7—7 and 8—8 of FIG. 5 showing the right angle air foil surfaces which produce the unusual aerial action.

Although, as will become apparent from the following description, the aerial toy can have many specific shapes and configurations provided certain criteria are met, FIGS. 1 through 3 illustrates the preferred form of aerial toy or disc formed in accordance with the invention and embodying the important features of the invention. Referring in particular to FIGS. 1 through 3, it will be seen that the device comprises a generally oval, disc-like body **10** preferably formed from a single sheet of plastic of relatively uniform thickness. The particular material from which the body is formed and the method used to form it are not important and any standard materials and forming methods can be used. For example, plastic, fiberboard or the like can be used.

The body **10** has a central opening **12** which extends completely therethrough. In the embodiment shown, the body **10** is symmetrical relative to a center line **14** and has a pair of relatively wide air foil surfaces **16** and **18** formed at the narrow ends of the oval body. As best shown in FIGS. **2** and **3**, each of the air foil surfaces **16** and **18** have a compound curvature such that when the body is rotated about a central axis **20**, a lift component is produced over the air foil surfaces **16** and **18** due to rotation of the disc member about axis **20**. Referring to FIG. **3**, it will be seen that in a plane parallel to axis **20** and **14**, the disc has a convex curvature best shown in FIG. **3**. Note that the top surface of the portions **16** and **18** is convex such that during rotation of the member, air passing over the surfaces must travel a greater distance than that passing under the disc to provide a low pressure zone with consequent lift.

In addition to the lift produced by the air foil surfaces **16** and **18** during rotation, lift is also produced merely because of translation through the air in a direction perpendicular to axis **20**. Referring to FIG. **2**, it will be seen that in planes perpendicular to axis **14** and parallel to axis **20**, the surfaces have a convex configuration. Therefore, as the disc moves through the air, air passing in the direction shown by the arrows produces a lift irrespective of the amount of spinning. The surfaces **16** and **18** are thus seen to have the ability to provide lift from movement of the body either spinning or translating.

As is apparent from the foregoing, the body **10** has an aerodynamic shape such that when the upper surface is oriented generally horizontally, it achieves lift from both spin about axis **20** and translation through the air in a direction perpendicular to the axis **20**. This permits the structure thus

far described to be used generally in the manner of a standard flying saucer or flying disc-type toy; however, in accordance with the preferred embodiment of the invention, an elongated elastic tether or band member is connected to the body at a particular location. As best shown in FIGS. **1** and **2**, a support member **24** is positioned across the open center portion **12** and has a swivel connector **26** positioned at its center which corresponds to the axis **20**. The elastic band or tether member **28** is connected to the upper end of swivel **26**. It will be noted that the point of connection **30** is shown slightly below the center of mass and general plane of rotation **34** of the air foil surfaces **16** and **18** when revolving about axis **20**. It has been found that, so long as the connection point **30** is generally at or below the plane **34**, the device will function in the intended manner. Referring again to the tether member, it should be understood that the entire length of the tether does not have to be elastic. Preferably, however, at least a major portion of it should be capable of substantial elongation and, in the preferred embodiment, approximately six feet of natural rubber band of the type used in model planes is used.

To understand the operation of the device, reference is made to FIG. **4** which shows in plan view a user holding one of the disc members **10** in his right hand and holding the free end of the tether **28** in his left hand. This is the typical position preparatory to throwing or launching the disc. With the right hand, the disc is thrown so that its general plane of rotation is substantially parallel to the earth with a spinning action as is generally done with a standard flying saucer-type device. The disc **10** sails away along the path **34** spinning about its axis **20** and stretching the tether **28**. When the throwing force imparted to the disc member **10** is overcome or balanced by the resistance to further elongation of the tether **28**, the horizontal translation of the disc along the path **34** ceases and reverses due to the forces exerted by the band **28**. If, at this time, a slight tug is applied to the band, the disc will sail back along the path **36** past the thrower to the opposite side. During the movement along path **34** to the end point **35**, lift is generated both by the rotation and the horizontal translation as described in the detailed description of FIGS. **1** and **2**. At its end point **35**, the horizontal translation has ceased and the lift is generated by the rotation. The rotation is sufficient to maintain the disc in an elevated position of stability. As the disc begins moving back along the path **36**, additional lift is generated by the translation through the air. Throughout the movement along paths **34** and **36**, the disc maintains its horizontal orientation. Through the normal gyroscopic action of this general class of device, stability is maintained.

The repeated passes past the thrower will continue so long as the device has a spinning motion. It has been found that flights for as long as one minute are possible provided that a substantial spin is imparted to the disc with the original throwing. Additionally, it should be understood that the disc can merely be thrown out and caught on the return flight along path **36** if desired. Further, the device can be used for various games, such as aerial fights, target shooting and the like. The important feature of the device is its ability to maintain flight stability both during movement away from the thrower, at its end point of outward flight, and throughout its return flight to or past the thrower.

Although, as will be apparent, many configurations could provide the desired combination of lift surfaces to assure lift both because of rotation and translation, and such other arrangements are within the scope of this invention, the particular embodiment shown has the following dimensions which have been found to be extremely satisfactory. These dimensions are not intended to limit the invention but merely to detail one specific structure which has been found to have exceptional flight characteristics.

1/16" Thick Polystyrene Plastic
Weight 5 ¼ oz.
A 9"
B 6 ¾"
C 5 ⅛"
D 9/16"
E ½"
F 1 7/8"
G 1 1/16"

Merely by way of further explanation, FIGS. **5** through **8** show a second embodiment of the device which has been found to be extremely stable in flight and capable of use in the manner described with reference to the FIGS. **1** through **3** embodiment. Referring in particular to FIGS. **5** and **6**, the device is shown as comprising a somewhat disc-like body **40** formed from a single piece of relatively thin plastic or the like and including three radially extending legs or vanes **42**. Legs or vanes **42** are preferably uniformly spaced and of identical size and shape. Each of the legs **42** has throughout its length, the cross-sectional shape shown in FIG. **8**. Note that the upper surface is convex so that when the body **40** spins about the axis **44**, lift is generated by the legs **42**. At the outer ends of each leg **42** is a vane or wing portion **46** which is generally perpendicular to the axis of the legs **42**. The wing of each end portion **46** has a cross-section best shown in FIG. **7**. It will be noted that this portion is convex about an axis perpendicular to the axis of the associated leg **42**.

The vanes **46** generate lift due to translation of the device through the air in a direction perpendicular to axis **44**. Thus, this embodiment utilizes two separate surfaces to generate the combined lift generated by the single surfaces **16** and **18** in the FIGS. **1** through **3** embodiment. Further, it should be understood that although the vanes or wing portions **46** are shown located symmetrically at the ends of the legs **42**, they could be offset in either direction or formed as a continuous curved end on legs **42**.

In the FIGS. **5** through **8** embodiment, the elastic tether is connected in generally the same manner as in the FIGS. **1** through **3** embodiment. Note that a tether **50** formed from a rubber or elastic strip or band is connected at the juncture between the legs **42**. It can be seen that this connection point is somewhat below the center of mass of the device. Although a swivel is not shown, one could be used if desired. Further, a wire or the like could extend upwardly from the center point for connection to the elastic tether. It is important however, that the point at which the forces are applied to the device from the band be somewhere at or slightly below the plane of rotation **52**.

In using the device, it is preferably held and thrown in the same manner described with reference to the FIGS. **1** through **3** embodiment.

Although the device has been described with reference to two specific embodiments, it should be understood that many modifications in overall configuration can be made without departing from the scope of the invention. Merely by way of example but not intending to limit the invention, it should be understood that the device of FIG. **5** could have the vane portions **46** continuous about its periphery and take the shape of a flat upwardly convex annulus. Also, for example, the device could be made adjustable so that variations in the relative orientation of the components could be adjustable to vary the flight characteristics as desired.

In addition to variations in general overall configuration, it should be appreciated that the device could be modified in many other ways. For example, bells, whistles, streamers and the like can be added to the device to change its visual and sound characteristics. Further, it can be manufactured in many colors and color combinations. It should also be understood that the devices can be sold or used alone or in combination with other types of game materials and devices.

The invention has been described with reference to preferred embodiments however, these embodiments are not to be construed as limiting the invention except so far as set forth in the appended claims and having thus described my invention.

I claim:

1. An aerial toy including a body having upper and lower surfaces with an axis about which the body is adapted to rotate, said axis extending generally through the center of mass of said body and said upper and lower surfaces defining

air foil surfaces including at least one first air foil surface portion for producing lift on said body due to rotation of said body about said axis and at least one second air foil surface portion generally at right angles to said first portion for producing lift on said body due to translation of said body through air in a direction generally perpendicular to the axis; and,

a tether connected to said body at a point generally on said axis.

2. The aerial toy defined in claim 1 wherein at least a portion of said tether is capable of substantial longitudinal elastic deformation.

3. The aerial toy as defined in claim 1 wherein said first and second air foil surface portions are formed by a common surface.

4. The aerial toy as defined in claim 1 wherein said tether is connected at a point beneath the plane of rotation of said body and extends over the upper surface of said body.

5. The aerial toy as defined in claim 1 wherein said air foil surface portions are part of a continuous surface.

6. The aerial toy as defined in claim 1 wherein said tether is capable of substantial elastic deformation throughout a major portion of its length.

7. The aerial toy as defined in claim 1 wherein said first and second air foil surface portions are on separate sections of said body.

8. The aerial toy as described in claim 1 wherein said body has at least two sets of said first and second air foil surface portions located symmetrically on said body.

9. An aerial toy comprising a disc-like body having upper and lower surfaces which define air foil surfaces capable of producing lift due to translation of the body through the air in a direction perpendicular to the plane of rotation; and,

a tether capable of substantial elastic elongation connected to the body at a location generally on the axis and whereby the user can hold a free end of the tether and throw the body with a spinning action to cause it to spin with its plane of rotation generally horizontally and translate through the air until the tether overcomes the force imparted to the body to cause it to return to the user, the air foil surfaces combined with the gyroscopic action of the body causing it to maintain stable flight.

10. The aerial toy as defined in claim 9 wherein said body includes at least two sets of air foil surfaces and wherein said axis passes through the center of gravity of said body.

11. The aerial toy as defined in claim 9 wherein said body has a generally oval shape with said air foil surfaces being at the narrow ends of oval.

12. The aerial toy as defined in claim 9 wherein said tether is connected at a location at or below the plane of rotation.

13. The aerial toy as defined in claim 9 wherein the body is symmetrical about a plane in which said axis lies.

14. The aerial toy as described in claim 9 wherein said tether passes over the upper surface of said body and is connected to said body through a swivel joint.

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