Aug. 9, 1966 W. B. MORROW 3,264,776

AERIAL TOY

Filed Feb. 16, 1966

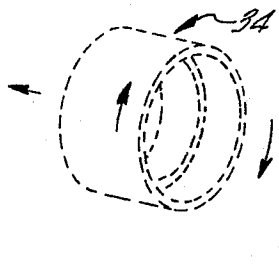


FIG. 5

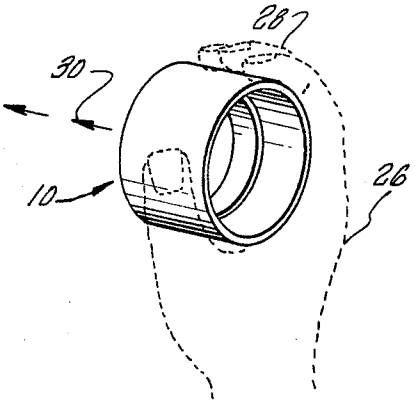


FIG. 3

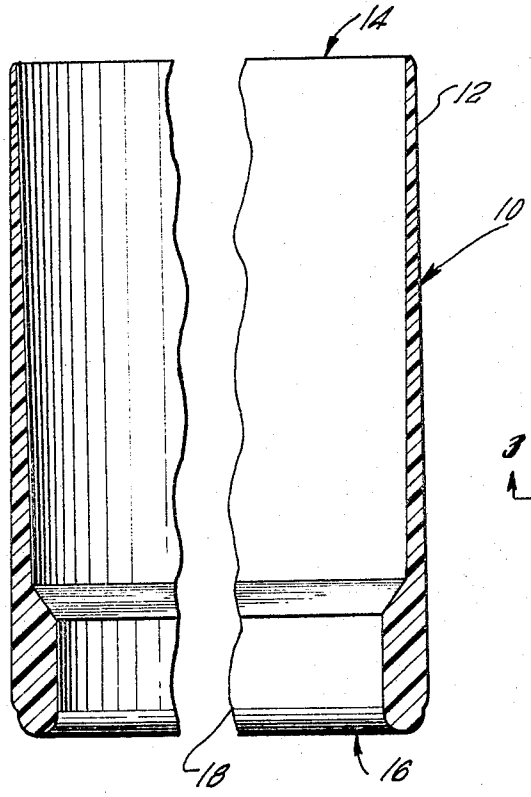


FIG. 1

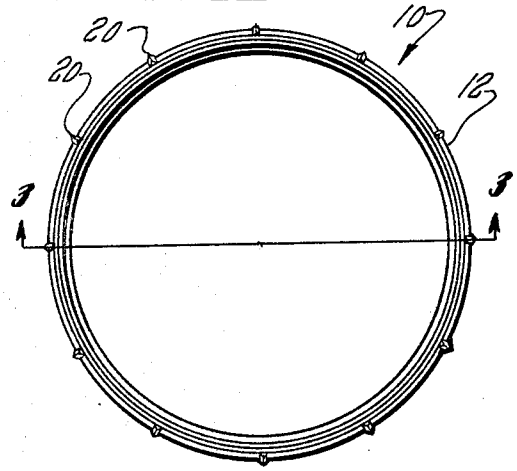


FIG. 4

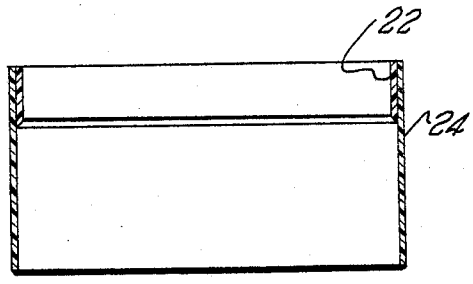
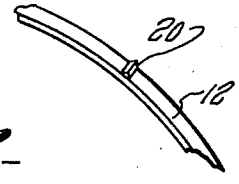


FIG. 2



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3,264,776

AERIAL TOY

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This is a continuation-in-part of application Serial Number 454,430, filed May 10, 1965, now abandoned. This invention relates to aerial toys and in particular to tubular devices exhibiting airfoil characteristics.

Flying or sailing toys have been a popular diversion since the inception of the kite and the boomerang. This is especially true of such toys as glider airplanes and other operator propelled devices, e.g. flying saucers, which relay on the aerodynamic properties of the device configuration for their operation. A partial list of such aerial toys includes items such as are described in U.S. Patents 2,683,603, 2,690,339 and 2,822,176.

To this list is now added the device of the present invention. The invention provides an aerodynamic toy comprising a straight, hollow and longitudinally unbalanced tube, open at both ends, and having a leading end and a trailing end. The tube is adapted to be propelled, leading end forward, with a rotational motion about its longitudinal axis so that the tube flies in a direction generally along its axis of rotation. The tube is provided with a weighted area adjacent to the leading end such that the center of gravity of the tube is located closer to the leading end than to the trailing end. Weighting in this fashion produces the longitudinal unbalance referred to above and it is this aspect of the device which is believed to result in a tube which exhibits airfoil characteristics.

In the preferred embodiment the tube is an open ended cylinder having a slight taper extending from the trailing end to the leading end on both the interior and exterior surfaces of the cylinder. In this embodiment the tube may be fabricated from polyvinyl chloride or other stiff and rigid materials and has a thickened area formed integrally with the cylinder wall at the leading end of the tube. Disposed along the exterior surface of the cylinder are a plurality of longitudinal ribs. These ribs have been found to provide a better gripping surface for the user to enable him to impart greater rotation to the tube when launched.

By providing certain alterations to the basic configuration of the toy of this invention certain specific flight characteristics can be imparted to it. Among these alterations are variations in the taper of the cylinder walls, the shape and weight of the thickened area located at the leading end and the location of grooves, ribs, or slots in the surface of the tube. Variations such as just enumerated result in a device which, when in flight, tends to curve to the right or to the left, to dip and rise even after being launched in a lower than horizontal trajectory, and to move in a helical pattern both clockwise and counterclockwise.

These and other features of the invention will be better understood by reference to the following figures in which:

FIG. 1 is a rear end view of the preferred embodiment of the device of this invention;

FIG. 2 is a detailed view of one of the longitudinal ribs provided on the exterior surface of the device of FIG. 1;

FIG. 3 is a section take along line 3—3 of FIG. 1;

FIG. 4 is an alternate embodiment of a device of this invention; and

FIG. 5 is an illustration of the launching and flight of the device.

Referring now to FIGS. 1 and 3, there is shown a

cylindrical tube **10** in which the ratio of the length to the outside diameter dimensions of the cylinder is selected to be approximately 1 to 1.2. As will be discussed in more detail below, the ratio of tube diameter to over-all length is important to the airfoil characteristics of the device and are maintained within certain limits in order to produce a practical device. The tube of FIG. 1 is preferably injection molded and is provided with a taper on both sides of cylinder wall **12** of approximately one-half degree from the center line of the wall. This taper extends from the trailing end **14** of the tube to the leading end **16** producing a gradually thickening wall **12** from back to front of the tube. Provided at the leading end **16** and formed integrally therewith is a weighted portion **18** circumscribing the interior side of the tube **10**. The weighted end **18** in this embodiment is accomplished by providing a substantial thickening of the cylinder adjacent the leading end.

The purpose of the weighted area is to add a sufficient amount of weight to the leading end of the device to cause the center of gravity of the tube **10** to be located closer to the leading end **16** than to the trailing end **14**. In the preferred embodiment the weighting is arranged such that the center of gravity is shifted such that it is located at a distance of approximately ⅓ the over-all length of the cylinder from the leading end of the tube. It has been found that, by providing a sufficient amount of balanced weight circumscribing the leading end of the tube, either in the form of a thickened area or by means of weights secured to the cylinder walls, that unusually long and stable flights result when the device is launched or propelled by a user with a rotational motion about its longitudinal axis imparted to it. Balancing of the weight at the leading end can be accomplished by means of an annular weight circumscribing the cylinder or by means of discontinuous weighting located at equal intervals around the circumference of the end.

To reduce wobble in flight, it has been found useful to add a plurality of ribs or ridges **20** raised from the exterior surface of the cylinder **12** and extending longitudinally along the exterior surface of the tube. A detailed view of one of the ridges **20** is shown in FIG. 2. By providing a series of such ridges around the outside of the device, the thrower is enabled to gain greater "purchase" on the surface of the device and to thereby impart greater rotation to it when launched. Greater rotation in flight has been found to result in reduced wobble.

In addition to the use of polyvinyl chloride, the device of this invention also lends itself to fabrication from other materials such as high and low density polyethylene, styrene, wood aluminum and many other materials which are stiff and rigid and have a specific gravity of approximately 0.9 or greater.

As indicated above, the relationship of the diameter of the tube to its over-all length is important in achieving satisfactory airfoil characteristics. It has been found that for a given length, instability of the device increases as the diameter of the tube increases. Where the ratio of length to diameter is less than 1 to 5, an impractial device is the result. As the ratio of these dimensions increases from 1 to 5, stability increases to the point where, at a ratio of between approximately 1:1 to 1:2, greatest stability is obtained. As the ratio increases still more to a ratio of approximately 5 to 1, an impractical device is again the result. While the preferred embodiment is cylindrical, other tube configurations are possible without departing from the scope of the invention. These include a tube which is polygonal or conical in cross-section.

A number of variations in the configuration described above are possible within the basic requirement that the

leading end be weighted for shifting the center of gravity to the forward half of the tube. The addition of weight at the leading end may be accomplished by providing a thickened portion as shown in **18** in FIG. 3 or by means of an annular weight **22** adhesively secured or force fitted within a straight cylinder **24** as shown in FIG. 4. In still another variation, the annular weight **22** having the same diameter as cylinder **24** is secured to the leading end of the cylinder by suitable means.

The use of a typical toy of this invention is shown in FIG. 5. In that figure the device is placed in the palm of the hand **26** with the fingers **28** wrapped around it and is thrown or launched forward in a direction indicated generally at **30**. In launching the device has, in addition to its forward motion, a spiral or rotational motion about its longitudinal axis imparted to its so that as it moves generally along its axis of rotation it is spinning about this axis as shown at **32** and **34**. While its direction of travel has been indicated as being generally along its axis of rotation, this is not meant to exclude the possibility that the device dips or rises or curves to the left and right while in flight. As the user's skill increases and more familiarity is gained with the use of the tube **10**, it can be made to perform these and other maneuvers while in flight. Alternatively a mechanical launcher can be used to propel the device.

Various changes and modifications may be made in the embodiment of the invention illustrated and described herein without departing from the scope thereof as determined by the following claims.

What is claimed is:

1. An aerodynamic device comprising a straight hollow tube having a leading end, a trailing end, and being substantially fully open at the ends, the tube having weighting means such that the center of gravity of the tube is located approximately within the leading one-third of the length of the tube and said device further having means comprising its length, weight and diameter so as to have aerodynamic properties when said device is propelled, leading end forward, with a rotational motion about its longitudinal axis.

2. An aerodynamic device according to claim **1** wherein the tube is cylindrical.

3. An aerodynamic device according to claim **2** wherein the weighting means are located at the leading end of the tube in a balanced distribution around its circumference.

4. An aerodynamic device according to claim **3** wherein at least one longitudinal rib is disposed on the exterior surface of the cylinder.

5. An aerodynamic device comprising a straight hollow tube having a leading end, a trailing end and being substantially fully open at the ends, the tube having a length to diameter ratio between about 1 to 5 and about 5 to 1 and the tube also having weighting means such that the center of gravity of the tube is located approximately within the leading half of the cylinder, said device further having means comprising its length, weight and diameter so as to have aerodynamic properties when said device is propelled, leading end forward, with a rotational motion about its longitudinal axis.

6. An aerodynamic device according to claim **5** wherein the tube is provided with weighting means such that the center of gravity of the tube is located approximately within the leading one-third of the length of the cylinder.

7. An aerodynamic device comprising a straight hollow tube having a leading end, a trailing end and being substantially fully open at the ends, the tube having a length to diameter ratio between about 1 to 1 and 1 to 2, the tube also having weighting means such that the center of gravity of the tube is located approximately within the leading one-half of the length of the tube and said device further having means comprising its length, weight and diameter so as to have aerodynamic properties when said device is propelled, leading end forward, with a rotational motion about its longitudinal axis.

References Cited by the Examiner

UNITED STATES PATENTS

2,568,111	9/1951	Bond	220—63
2,573,375	10/1951	Winstead	206—47
2,798,636	7/1957	Ketchledge	220—63
2,818,167	12/1957	McKinley	206—56
2,863,454	12/1958	Davidson et al.	206—63.2
3,137,405	6/1964	Gorcey	220—63 X

FOREIGN PATENTS

643,952	4/1937	Germany.

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