United States Patent

Seefluth

[15] **3,662,487**

[45] **May 16, 1972**

[54] BALLOON-TYPE AIRCRAFT TOY

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[22] Filed: **Oct. 9, 1969**

[21] Appl. No.: **865,144**

[30] **Foreign Application Priority Data**

Oct. 12, 1968 Germany ..... P 18 02 813.2

[52] **U.S. Cl.** **46/44**, 46/56, 46/82, 46/88

[51] **Int. Cl.** **A63h 29/16**

[58] **Field of Search** 46/44, 56, 82; 416/20; 244/17.19

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Primary Examiner—Louis G. Mancene
Assistant Examiner—A. Heinz
Attorney—Polachek, Saulsbury & Hough

[57] **ABSTRACT**

The balloon-type aircraft toy according to the invention includes an inflatable balloon adapted to be filled with compressed gas having its interior communicating via ducts with the outer ends of rotor blades releasably secured to a rotor hub in such a manner that the pitch angle of the blades may be adjusted. At the ends of the blades the compressed gas is deflected and discharged out of nozzles thereby forming a reaction-type drive for rotating the blades. The rotor blades are made of a plurality of self-supporting interconnected light weight bodies, such as molded bodies of foamed synthetic resin or hollow bodies made of bent foils of plastic material.

13 Claims, 12 Drawing Figures

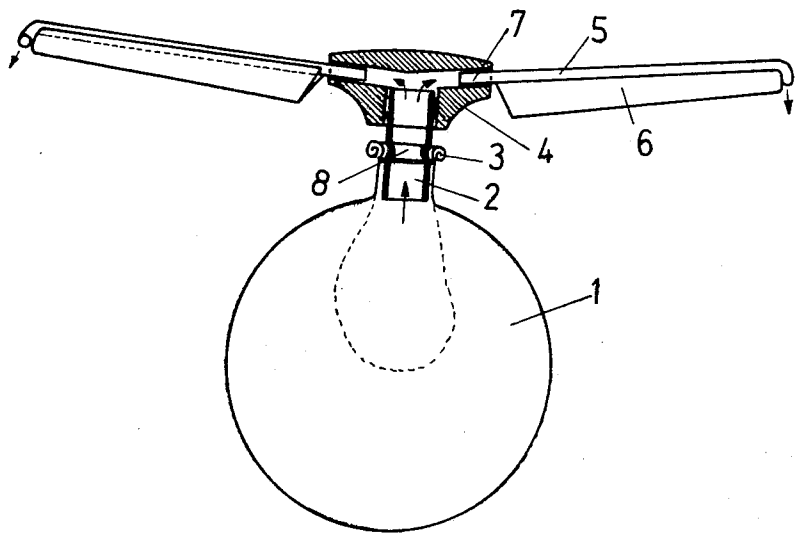

Fig.1

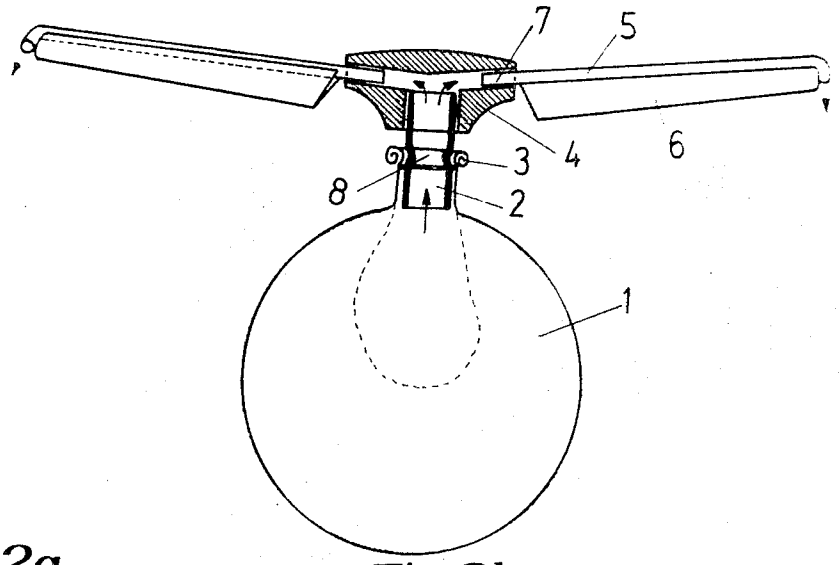

Fig.2a

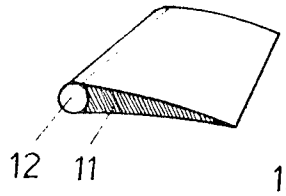

Fig.2b

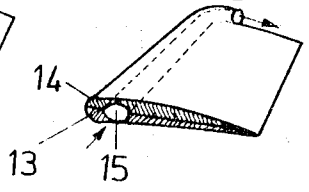

Fig.2c

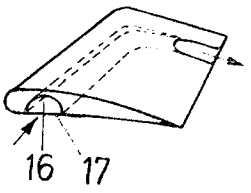

Fig.2d

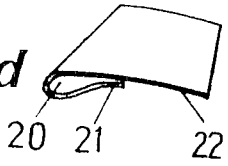

Fig.2e

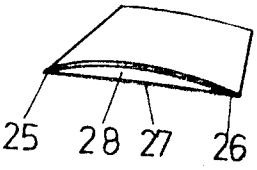

Fig.3a

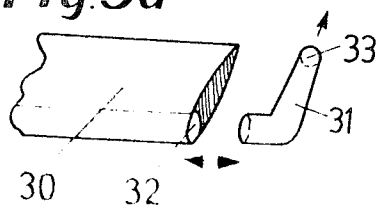

Fig.3b

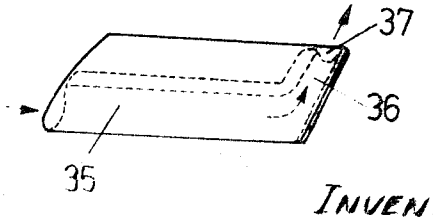

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Fig. 4a

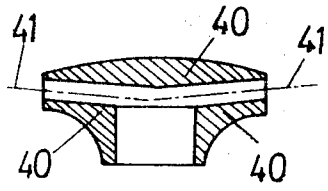
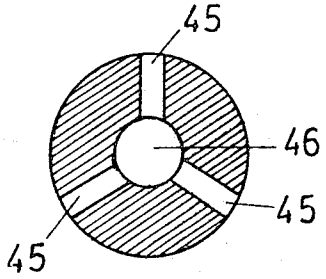


Fig. 4b



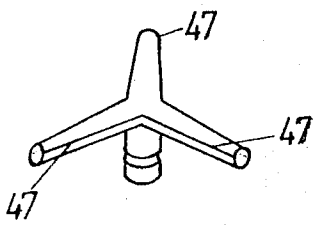


Fig. 4c

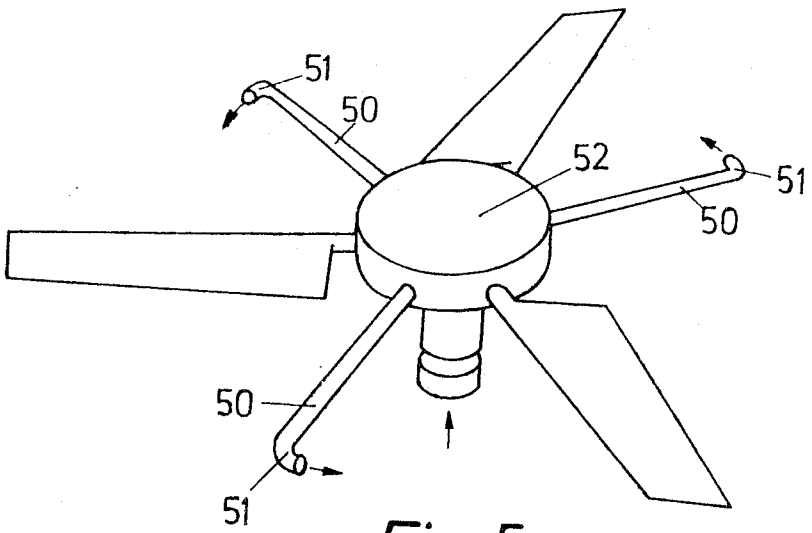


Fig. 5

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BALLOON-TYPE AIRCRAFT TOY

BACKGROUND OF THE INVENTION

This invention relates to a balloon-type aircraft toy including a propeller and an inflatable balloon adapted to be filled with compressed gas such as air and communicating with ducts extending outwardly from the propeller hub. The outer ends of the ducts are formed as nozzles deflecting and discharging the gas to form a jet propulsion for rotating the propeller.

In such aircraft toys it is absolutely necessary that the weight of the propeller and the drive mechanism are kept at a minimum in order to obtain a sufficient and satisfactory range of flight. In such aircraft toys it is known already to drive the propeller by an air motor, such as a wing cell motor arranged adjacent the propeller hub. However, practice has shown that the weight of such a construction is so great that the required range of flight is not sufficient, if an elastic balloon is used as a pressure reservoir.

In any of the known constructions which use a compressed air jet propulsion with discharge nozzles arranged at the tips of the propeller blades a rigid, relatively heavy weight, two bladed propeller was employed communicating with the compressed air supplying balloon via an air duct. It has been found that the total weight in these known constructions is so great that a satisfying flight capacity is not obtainable, and in fact it may be stated that the hitherto proposed embodiment of such aircraft toys are not capable to fly due to the relatively high surface load of the propeller blades and to the use of not stabilized two bladed propellers. In addition it is not possible in these known constructions to adjust the propeller capacity in accordance with the compressed air capacity of the balloon being used, all the more so as the wall tension of the balloon decreases in the course of time and can only be compensated for to some degree by changing the propeller capacity, or the speed of the propeller. Another drawback of the known proposals is to be seen in the fact that only special balloons having a separate air inlet can be used which is not only disadvantageous with respect to the manufacture but also increases the weight of the toy and thus decreases the flying capacity considerably.

Thus the invention aims to provide a balloon-type aircraft toy avoiding the disadvantages the known toys of this type are afflicted with, having a weight in flying order which, due to an advantageous construction, is so little that good flying capacities at long flight ranges are obtained.

Another object of the invention is to provide a toy of the above mentioned type in which the lift capacity of the propeller is variable in order to adjust the same on the one hand to the prevailing compressed air capacity which may possibly change in the course of time due to a decrease of the wall tension of the balloon, and on the other hand to obtain low flying altitudes in closed rooms and greater flying altitudes in the open.

SUMMARY OF THE INVENTION

The invention is characterized by the combination of:

a hollow rotor hub;

a plurality of airfoil-shaped propeller blades extending radially from said rotor hub forming a rotating wing each blade being composed of a plurality of self-supporting interconnected longitudinal sections made of light weight material, such as foamed plastic material, or profiled foils of plastic material;

positive attachment means between said rotor hub and the radially inwardly disposed ends of said propeller blades allowing twisting of said blades about their longitudinal axes and thereby adjustment of their pitch angles;

an inflatable balloon made of elastomere material detachably secured to the underside of said rotor hub and serving as a compressed air reservoir;

drive means for said propeller of the reaction propulsion type formed by air ducts extending radially outwardly from said rotor hub communicating with the interior of said balloon and including nozzles formed at their outer ends deflecting and discharging the air supplied out of said balloon substantially in tangential direction relative to the peripheral path described by the outer ends of said blades.

Various embodiments of the invention are possible without departing from the scope of the invention as defined in the appended claims, and which will become evident from the following detailed description of various embodiments in connection with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of the toy according to the invention, partly shown in section;

FIGS. **2***a* to **2***e* are perspective views of various embodiments of the rotary wing blades according to the invention;

FIGS. **3***a* and **3***b* are perspective views of different rotary wing tips;

FIG. **4***a* is a sectional view of the rotor hub in axial direction;

FIG. **4***b* is a sectional view of the rotor hub in radial direction;

FIG. **4***c* is a perspective view of the rotor hub according to another embodiment; and

FIG. **5** is a perspective view of the toy according to another embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. **1**, there is shown an aircraft toy using a customary inflatable toy balloon **1** of elastomere material in connection with a tubular stud **2** to which the balloon is releasably attached with its beaded hose-like opening **3**. For inflating the balloon by exhaling or pumping the stud together with the balloon attached thereto is pulled out of the rotor hub **4**. After the balloon has been inflated with air the stud **2** is reinserted into the rotor hub. The air compressed within the balloon flows through air channels provided in the rotor hub **4** and through air ducts **5** provided in the propeller blades **6** and is discharged from the tips of the blades in a substantially tangential direction with respect to the annular path described by the tips of the propeller blades, whereby the rotor together with the balloon are rotated. Since the propeller blades **6** are set at a pitch angle the toy immediately starts to gain altitude and to fly. In the embodiment shown in the exemplified embodiment of FIG. **1** the air ducts **5** of the propeller blades **6** are extended at the root of the blades wherein the air ducts **5** in this zone are used as attachment elements for releasably securing the blades **6** with frictional fit to the rotor hub **4**, of course any other positive connection means may also be used. The extended ends **7** of the air ducts **5** are cylindrical, thereby allowing adjustment of the pitch angle of the propeller blades by twisting the blades about their longitudinal axes. Depending on the air pressure and the elasticity of the balloon, the pitch angle of the propeller blades may be chosen more or less great, whereby the rotating speed and the torque of rotor may be influenced. This allows to adapt the rotary wing type blades to the type of balloon and to the prevailing air pressure in the balloon.

The rotor hub should be constructed as light as possible, and to this end consists of a light-weight body, such as a body of foamed plastic material, provided with straight circular air channels extending in a direction toward the propeller blades and toward the balloon suspended from below. These air channels open into a common collection chamber thus communicating with each other receiving in their outer radially directed ends the extended ends **7** of the air ducts of the propeller blades, and in their axially directed end the stud **2** of the balloon **1** by merely inserting the same.

The tubular stud or intermediate tube **2** arranged between the balloon **1** and the rotor hub **4** has an annular groove **8** formed in its outer surface at the end facing the balloon in which a portion of the hose-like balloon opening **3** engages

due to the elasticity of the material the balloon is made of. In this manner the balloon is safely secured to the tubular stud **2**.

In order to increase the strength of the rotor hub and to prevent damages thereof when inserting the stud **2**, a not illustrated piece of a tube may be inserted into the lower opening of the rotor hub **4**, and may be bonded therein, which tube for reasons of saving weight, may be made of light, thin-walled material. Into this short piece of tube the stud **2** secured to the balloon **1** is inserted. In order that customary balloons may be used a balloon with only one hose-like tapering opening is used serving to secure the ballon to the rotor hub and simultaneously to inflate the balloon.

In order to obtain a good flight stabilization of the aircraft toy the propeller blades extend slightly angularly upwardly from the rotor hub to which they are secured, as shown in FIG. **1**, so that the plane in which the propeller blades rotate forms a flat cone. Of course the propeller blades may also extend slightly downwardly. An advantageous feature of this invention is to be seen in that the direction of the air discharged out of the nozzles at the tips of the propeller blades may deviate obliquely outwardly relative to the rotary path described by the propeller blade tips, achieved by correspondingly shaping the outer free ends of the air ducts. Due to this outwardly directed jet angle, which may amount up to 45° as a maximum, the advantage is gained that the aircraft toy may be used in closed rooms turning-off in front of obstructions thus less likely colliding with the walls of the room.

In order to prevent fluttering movements and breaking away of the aircraft toy during its flight, the rotary wing advantageously includes three or more blades, of which at least one includes an air duct with a discharge nozzle. If only two rotor blades are used stabilizing surfaces, rods, or any other bodies causing a stabilizing effect are provided between the rotor blades in the plane of rotation.

In FIGS. **2***a* to **2***e* various embodiments of composed light weight constructions of the propeller blades are shown. The propeller blade **11** shown in FIG. **2***a* is made of light weight material or foamed plastic material, such as polystyrol, or balsa wood respectively. The air duct **12** is provided at the leading edge of the blade **11** and consists of a thin-walled tube made, for example, of plastic material. The air duct **12** and the blade **11** are bonded together by adhering, welding, or in any other suitable manner. The rotor blade shown in FIG. **2***b* is composed of two halves **13** and **14** including profiled grooves in the zone of the greatest thickness which after assembly of the two blade halves are aligned to each other, thereby forming an air duct **15**. The rotor blade according to FIG. **2***c* also consists of light weight material, or foamed plastic material respectively, provided at its upper or lower surface with a recess **16** covered by a foil **17** which may be adhered to the surface, whereby a longitudinally extending air duct is formed having a cross sectional shape of about half a circle, or a similar shape respectively.

FIG. **2***d* shows an airfoil rotor blade made of a foil of plastic material return bent at the leading edge. The two trailing ends **21** and **22** extend in parallel relation relative to each other and are welded or adhered together, wherein for weight-saving reasons the one end may project beyond the other end of the foil. According to the exemplified embodiment of a rotor blade shown in FIG. **2***e* two foils of plastic material are bonded together at their leading as well as at their trailing edges **25** and **26**. The upper foil is slightly curved upwardly, while the lower foil **27** has a lesser curvature, or is planar respectively, whereby an air duct **28** is defined between the two foils. The edges of the foils may also be connected by welding or adhering. The profiled hollow space defined by the two curved foils, or by the return bent foil respectively, may have a circular cross sectional shape at the root of the rotor blade surrounding an inserted thin-walled tube projecting outwardly serving to secure the rotor blade to the rotor hub.

In FIG. **3***a* and **3***b* the nozzles at the tips of the rotor blades are shown in perspective views. According to the embodiment shown in FIG. **3***a* a tubular member **31** including a rearwardly directed nozzle-like opening **33** is mounted tangentially relative to the rotating path of the blade tip at the end of the blade communicating with the air duct **32** extending longitudinally through the rotor blade. This structure is advantageously shaped fully or partly as a streamlined body. According to the embodiment shown in FIG. **3***b* the hollow space of the rotor blade **35** made of a return bent plastic material foil ends at the tip **36** of the blade with a rearwardly extending portion disposed tangentially to the rotary path of the blades including a nozzle-like opening **37**. The hollow space defining the air duct is suitably made in such a manner that the zones of the foil forming the upper and lower surface of the blade are adhered or welded together at a suitable location.

There are various possibilities in constructing the rotor hub. According to FIG. **4** the rotor hub consists of a body of foamed plastic material provided with channels for the air flowing out of the balloon into the rotor blades. These channels are preferably straight and of circular cross sectional shape. The rotor hub may also be composed of two halves bonded together in any suitable manner at the line of separation **41**. FIG. **4***b* shows in which manner the air channels **45**, in which the rotor blades are secured, are communicating with the vertically extending main air channel **46** communicating with the interior of the balloon. FIG. **4***c* shows a similar type of rotor hub, however, not made of foamed plastic material but of molded thin-walled plastic material. In this case also the rotor hub may be composed of an upper and a lower half joined in the plane of line **47**, thus enabling a simple construction and manufacture of the rotor hub.

FIG. **5** shows a different arrangement of the air ducts, or nozzles respectively, secured to the rotor hub by means of which it is achieved that the propeller blades are free of air ducts and nozzles. The freely extending tubular air ducts **50** are secured to the rotor hub by inserting them into openings communicating via channels with the interior of the balloon. The nozzles **51** are preferably arranged in such a manner that the discharged air is directed obliquely downwardly relative to the plane of rotation of the blades. In this case the propeller blades are secured to the rotor hub **52** in such a manner that they may also be twisted about their longitudinal axes for adjusting the pitch angle of the blades. In this case also, the blades are made of light-weight material, such as balsa wood, or the like.

The advantages achieved by the invention are to be seen primarily in the fact that an aircraft toy is provided using a customary toy balloon and having good flying characteristics and flying ranges. The advantages regarding the construction are to be seen primarily in the fact that the propeller blades, the air ducts, the rotor hub, and the connection with the balloon consist of a minimum of parts of extremely light-weight material, whereby only this is really the reason for the good flight performance achieved by the aircraft toy according to the invention. Finally another advantage must be seen in the fact that the toy may be disassembled whereby it may be packed as a unit in a relatively small package together with one or a plurality of spare balloons.

What I claim is:

1. An aircraft toy, comprising in combination: a hollow rotor hub member; a plurality of at least three air foil-shaped propeller blade members each extendable radially from an inwardly disposed end of said each of said blade members at said rotor hub member forming a rotatable wing; each blade being composed of a plurality of self-supporting interconnected longitudinal sections made of light weight plastic material; frictional first attachment means between said rotor hub member and the radially inwardly disposed ends of said propeller blades allowing said blade members to be releasably detached from said rotor hub member and also permitting twisting of said blades about their longitudinal axes and thereby adjustment of their pitch angles; an inflatable balloon having a single mouth, and made of elastomer material; second attaching means for detachably fixedly attaching and securing said balloon to the underside of said rotor hub member such that the

balloon is rotatable with the rotor hub member and such that the balloon serves as a compressed air reservoir; drive means for said propeller of the reaction propulsion type formed by air duct extending radially outwardly from said rotor hub member communicating with the interior of said balloon and including nozzles formed at their outer ends deflecting and discharging the air supplied out of said balloon substantially in tangential direction relative to the peripheral path described by the outer ends of said blades; and said hollow rotor hub member including an axially downwardly extending channel forming a collecting chamber from which said balloon is suspended and communicating with radially outwardly extending channels receiving said air ducts, said second attaching means including a tubular member which is detachably insertable into said axially downwardly extending channel having an annular groove formed at a hose-like opening of said single mouthed balloon.

2. An aircraft toy according to claim 1, in which said hollow rotor hub member is made of a molded plastic material of foam composition.

3. An aircraft toy according to claim 1, wherein said detachable balloon, said detachable member, and at least one spare balloon are combined dissassembled with remaining parts of said toy as a compact unit.

4. An aircraft toy according to claim 1, wherein said attachment means between said rotor hub and each of said blades is formed by a hollow stud projecting from one of said blade members frictionally engaging a correspondingly shaped aperture of the rotor hub member and forming a connection between the interior of said balloon and said air duct.

5. An aircraft toy according to claim 4, wherein said air ducts are formed by tubes extending longitudinally through said propeller blades projecting out of the inwardly disposed end and bent at their outer ends to form said nozzles.

6. An aircraft toy according to claim 5, wherein said air ducts are forming the leading edges of said propeller blades and are bonded to the bodies of said propeller blades made of foamed plastic material.

7. An aircraft toy according to claim 6, wherein each propeller blade includes an upper part bonded to a lower part, said upper and lower parts including mating recesses facing each other so as to form said air ducts.

8. An aircraft toy according to claim 6, wherein each propeller blade body has a longitudinal extending recess formed in one of its side surfaces covered by a plastic foil bonded to said surface so as to form said air duct.

9. An aircraft toy according to claim 1, wherein each propeller blade consists of plastic material foil including an upper convex portion and a lower substantially flat portion defining together a hollow space serving as air duct said hollow space having a tubular extension formed at its inner end forming said attachment means communicating via said hollow rotor hub with the interior of said balloon and an aperture formed in the trailing edge at the outer end forming said nozzle.

10. An aircraft toy according to claim 9, wherein said upper and said lower portion are formed of an integral foil bent at about 180° at the leading edge of said propeller blade and bonded together with their free edges.

11. An aircraft toy according to claim 1, wherein the rotating plane described by said propeller blades is a flat cone.

12. An aircraft toy according to claim 1, wherein the direction of the air discharged out of said nozzles deviates obliquely outwardly relative to the tangent of the rotary path of the propeller blade tips.

13. An aircraft toy according to claim 1, wherein said air ducts are separate tubular members connected to said rotor hub intermediately said propeller blades.

* * * * *