United States Patent

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[54] **FLYING ROTORCRAFT TOY**
3 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **46/74 D,** 244/23 C
[51] **Int. Cl.** **A63h 27/00**
[50] **Field of Search** ..... 46/1 J, 740, 75, 243 AV; 244/12 C, 23 C, 17.23, 17.25, 42.4, 42.6, 44

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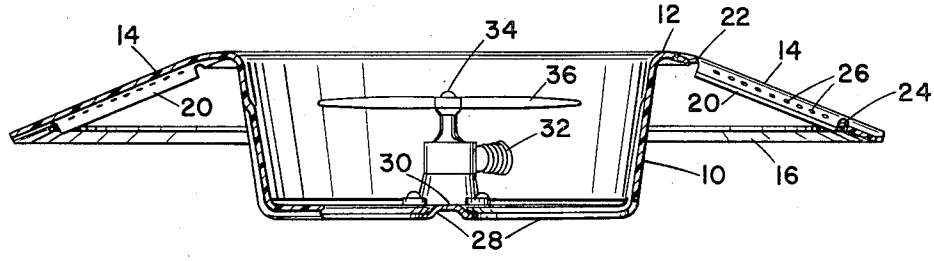
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ABSTRACT: A flying toy having a driven propeller mounted in a duct, with lifting rotor blades extending from the top of the duct, the outer ends of the blades being interconnected by a protective annular ring. The duct and blade assembly rotates in the opposite direction to the propeller, due to torque, the lift of the blades adding to that of the propeller for vertical propulsion. When power is shut off, the toy descends gently in autorotation. The airframe structure is a simple unitary molding and the rotor blades are partially adjustable in pitch to vary the effective lift and thus control the flight.



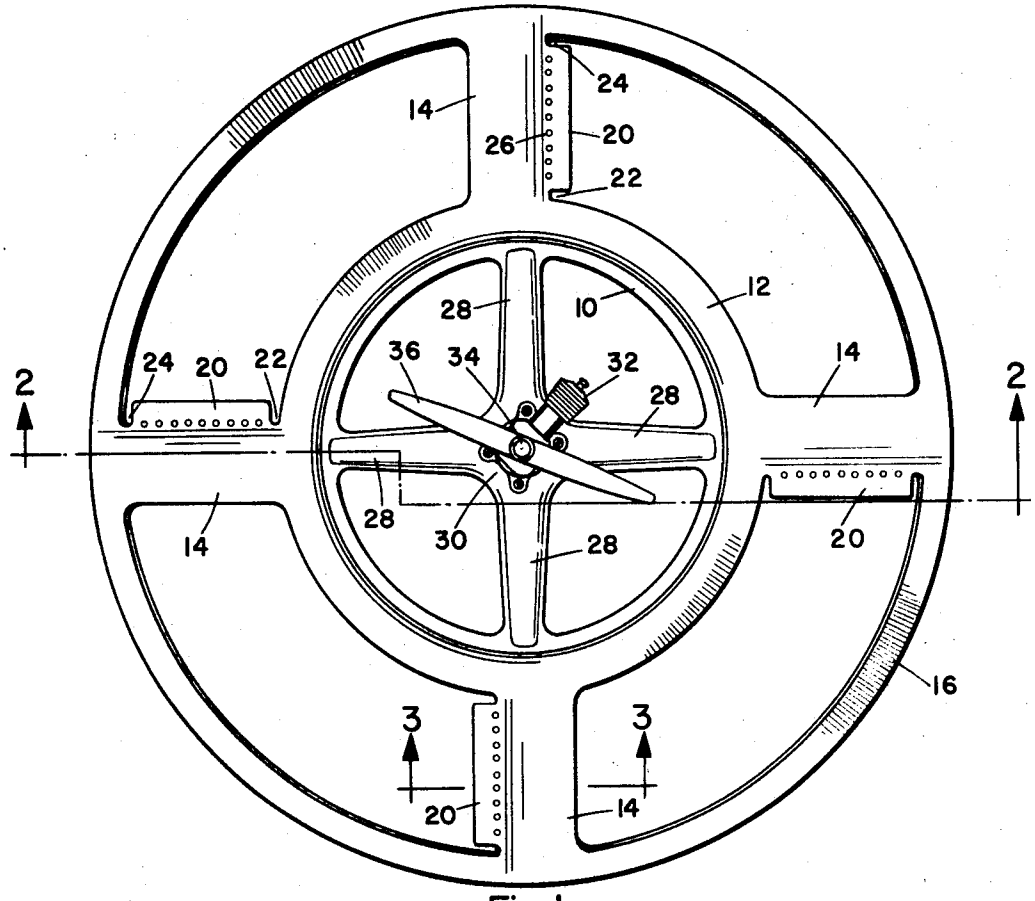


Fig. 1

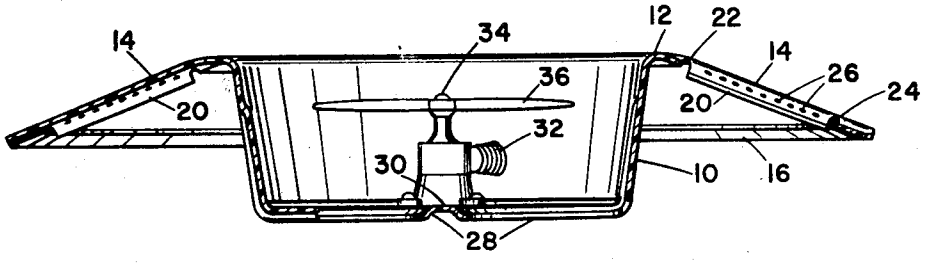


Fig. 2

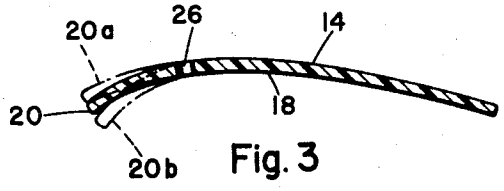


Fig. 3

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FLYING ROTORCRAFT TOY

BACKGROUND OF THE INVENTION

Rotary type flying vehicles usually have some form of propeller or fan propulsion for vertical lift, an airframe being suspended from the propulsion means and stabilized in a suitable manner. Unless counter rotating propellers or fans are used, some antitorque means is used to prevent the air frame from rotating. This leads to complications which may be unnecessary, particularly in a toy.

SUMMARY OF THE INVENTION

The flying toy described herein has an engine mounted in a duct and driving an axially thrusting propeller. At the top of the duct are outwardly extending rotor blades, joined at their outer ends by a protective annular ring. The rotor blades have portions which are adjustable to vary the effective pitch and thus control the lift. With the engine in operation, the propeller rotates in one direction and the entire airframe rotates in the other direction, due to torque, the lift of the rotor blades adding to the lifting thrust of the propeller. In unpowered flight, the unit autorotates to a gentle landing.

It is therefore an object of this invention to provide a new and improved flying rotorcraft toy.

Other objects and many advantages of this invention will become more apparent upon a reading of the following detailed description and an examination of the drawing wherein like reference numerals designate like parts throughout and in which:

FIG. 1 is a top plan view of the complete rotorcraft.

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

FIG. 3 is an enlarged sectional view taken on line 3—3 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The rotorcraft can be assembled from parts but is preferably in the form of a unitary frame which is easily molded or otherwise made from plastic material. The structure comprises a generally cylindrical duct **10** having an outwardly rolled upper rim **12**, from which a plurality of rotor blades **14** extend substantially radially. Four blades are shown as an example, but other arrangements could be used. Blades **14** are inclined downwardly from the top of duct **10** and their outer ends are interconnected by an annular tip ring **16**, the blades and ring being in a substantially conical configuration. Each rotor blade **14** is curved in cross section with a concave underside **18**, and has a leading edge portion **20** extending forward in the direction of rotation. The leading edge portion is separated from the rim **12** and tip ring **16** by notches **22** and **24**, and is provided with a row of spanwise perforations **26** which facilitate bending of the leading edge, as hereinafter described.

At the lower end of duct **10** are radially inwardly extending arms **28** supporting a central platform **30**, on which an engine **32** is mounted with its drive shaft **34** vertical. The engine is a

conventional glow plug ignition type as used in model aircraft, and various types and sizes are readily available. The downwardly thrusting propeller **36** need not be a particularly close fit within the duct, since the power to weight ratio of the craft is high. counterclockwise rotation is standard with such engines, so rotor blades **14** are arranged for clockwise rotation.

To operate the rotorcraft the engine is started in the conventional manner and adjusted for maximum power. The craft is launched in a generally horizontal motion, preferably with a clockwise rotating motion for assistance. Propeller thus will sustain the craft and torque will increase the rotation speed of the frame, the combined lift of the propeller and rotor blades causing the craft to rise. The rotation gives the craft considerable gyroscopic stability and there is no tendency to pitch over or oscillate violently. The rate of climb is controlled by adjusting the leading edge portions **20**, as shown in FIG. **3**. By bending the leading edges up, as in one broken line position **20***a*, the effective pitch angle of the blade **14** is increased and the craft will climb rapidly. Bending the leading edge down, as in the other broken line position **20***b*, the blade pitch is effectively decreased and climb is minimized, the craft tending to fly nearly horizontally. All the blades should be adjusted as nearly as possible to the same position, but the settings are not critical.

When the fuel is exhausted and the engine stops, the craft will autorotate to a gentle landing. While a rotor usually reverses its direction of rotation to autorotate when power is shut off, it has been found that the inertia and flywheel action of the craft tend to maintain the rotation in the driven direction for some time, resulting in a prolonged flight.

When made from suitable plastic material, the frame will withstand considerable rough usage and the leading edge portions can be bent many times without breakage. The tip ring **16** provides gripping means for launching, strengthens the blades and protects the user's hands from the blades when the craft is rotating.

Having described my invention, I now claim.

1. A flying rotorcraft, comprising,

a substantially cylindrical duct having an outwardly rolled upper rim,

a plurality of substantially radial rotor blades extending outwardly and angularly downwardly from said rim,

a tip ring interconnecting the outer ends of said blades, said tip ring, blades and rim being in a conical configuration coaxial with said duct,

arms extending across the lower end of said duct and having a platform thereon,

and an engine secured on said platform, with a driven propeller thereon mounted for axial rotation is said duct.

2. A rotorcraft according to claim **1**, wherein each of said rotor blades has a spanwise row of perforations, for providing a bendable leading edge portion thereof.

3. A rotorcraft according to claim **2**, wherein said duct, said arms, said rotor blades and said tip ring are made from a single piece of material.