June 13, 1950 R. L. McMULLEN ET AL 2,511,360

FLYING TOY AND LAUNCHING MEANS THEREFOR

Filed Jan. 19, 1946 2 Sheets-Sheet 1

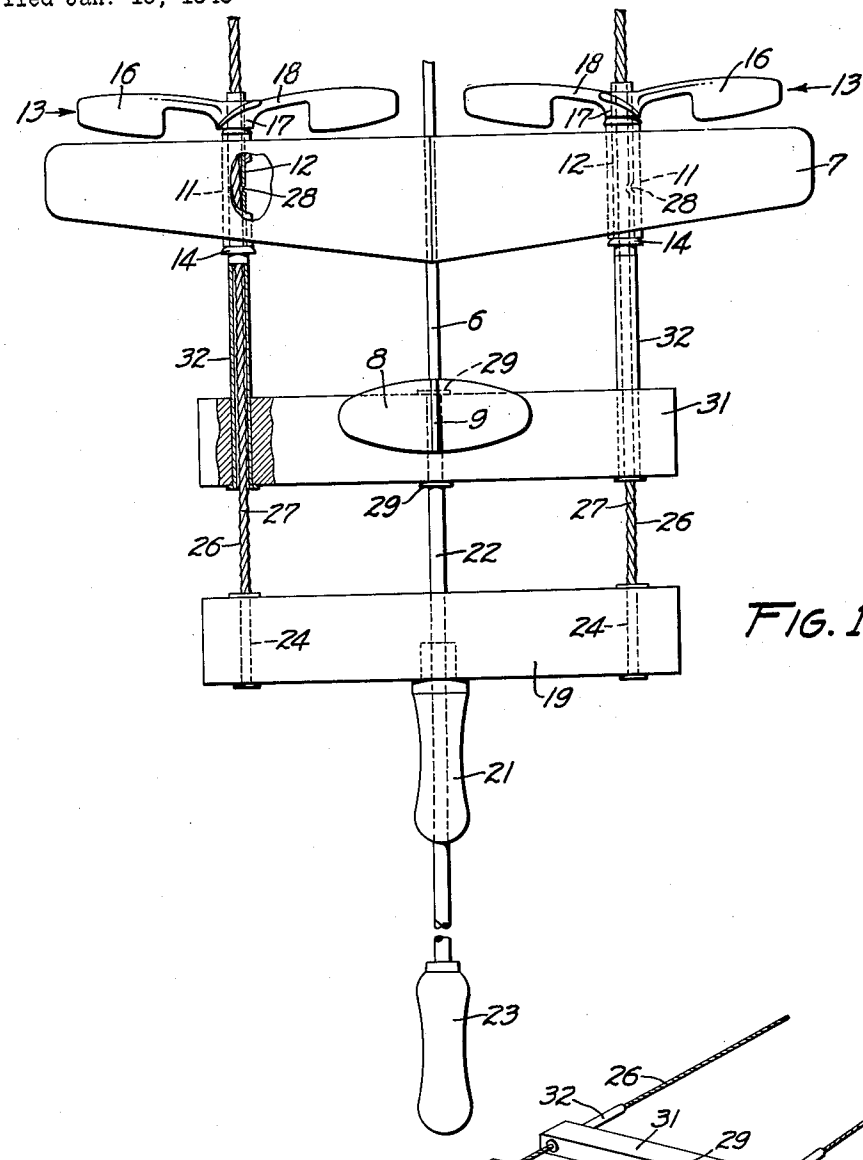


FIG. 1

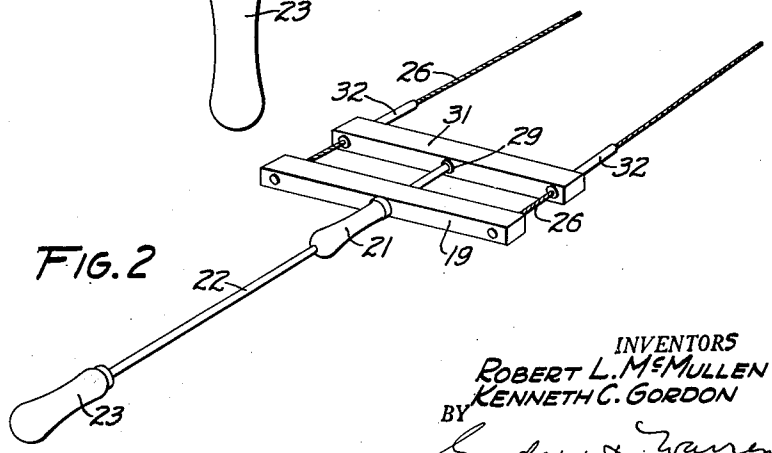


FIG. 2

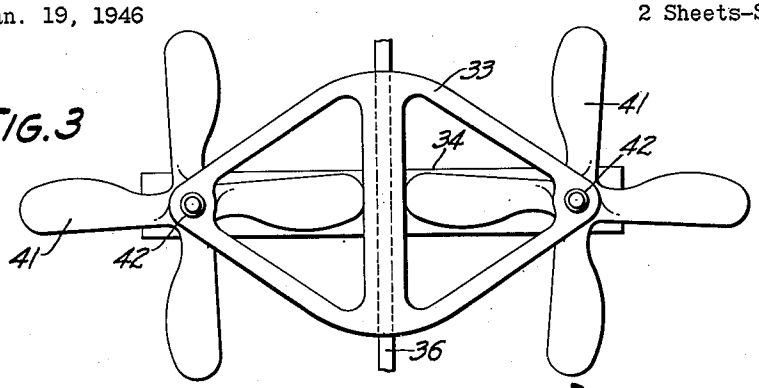
INVENTORS
ROBERT L. McMULLEN
KENNETH C. GORDON
BY
Gardner & Warren
their attorneys

June 13, 1950 R. L. McMULLEN ET AL 2,511,360

FLYING TOY AND LAUNCHING MEANS THEREFOR

Filed Jan. 19, 1946 2 Sheets-Sheet 2

FIG. 3



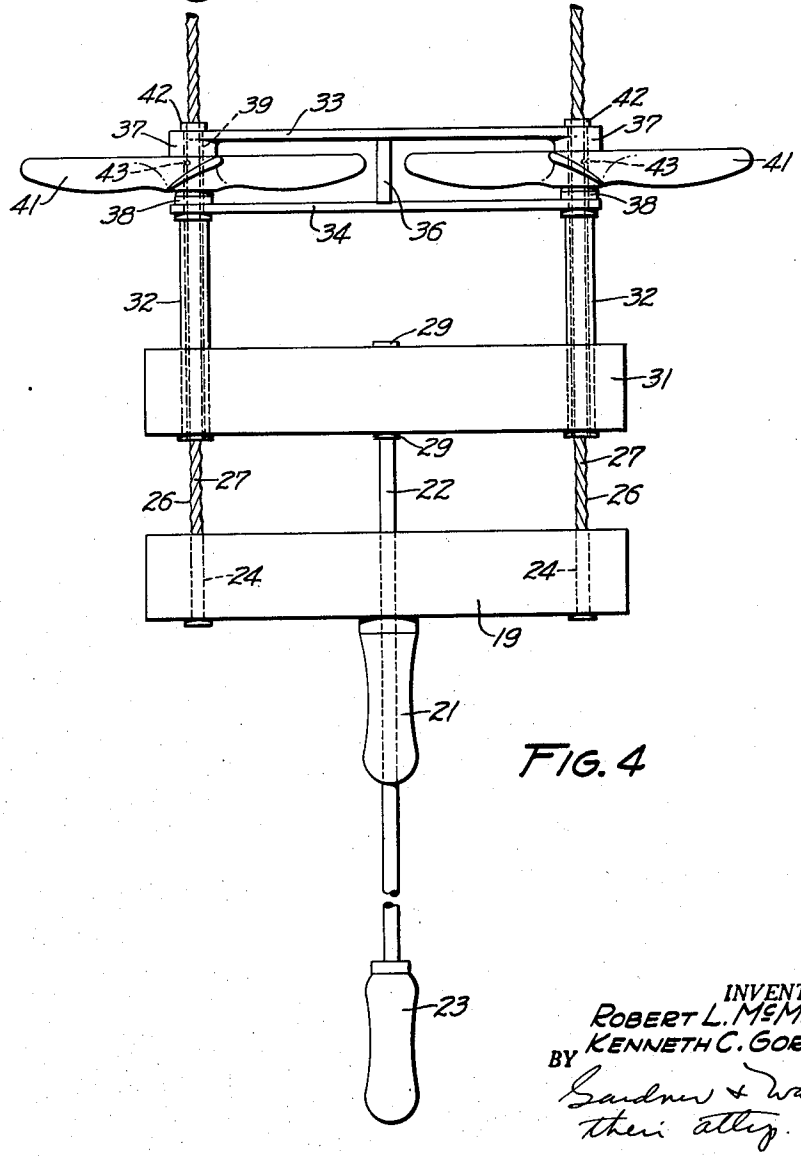


FIG. 4

INVENTORS
ROBERT L. McMULLEN
KENNETH C. GORDON
BY Gardner & Warren
their atty.

Patented June 13, 1950 2,511,360

UNITED STATES PATENT OFFICE

2,511,360

FLYING TOY AND LAUNCHING MEANS THEREFOR

Robert L. McMullen, Oakland, Calif., and Kenneth C. Gordon, Seattle, Wash.; said Gordon assignor to said McMullen

Application January 19, 1946, Serial No. 642,150

4 Claims. (Cl. 46—75)

1

This invention relates to toys capable of aerial flight substantially solely by rotational momentum imparted to a flight thrust member carried by the toy.

An object of the invention is to provide a rotor-actuated aerial toy in which reaction torque of the rotor on the body of the toy, tending to counter-rotate the latter, is counteracted or rendered unobjectionable.

Another object of the invention is to provide a rotor-actuated aerial toy and a launching device therefor relatively designed to reduce possibly destructive strains created in the toy by the sudden application thereto of an abnormally forceful launching thrust.

A further object of the invention is to provide a toy which is capable of more accurately directed flight than are comparable devices of this general type.

Still another object of the invention is to provide a launcher, for aerial flight toys embodying flight sustaining members rotatable by movement of a rotation-imparting element relative to the launcher, which confines the movement of the toy, and stabilizes the latter against the reaction torque occasioned by imparting rotation to the flight-sustaining members, to a linear path coincident with and forming part of the resulting flight path of the toy.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

Referring to the drawings:

Figure 1 is a plan view of one form of aerial toy and launcher of our invention showing the relative positions thereof at the start of the launching operation.

Figure 2 is a perspective view of the launcher.

Figure 3 is a top plan view of a helicopter-type toy embodying the improvements of my invention.

Figure 4 is a side elevational view of the structure of Figure 3 showing the launcher associated therewith.

Numerous designs of flying toys have been proposed embodying a single air screw or flight rotor capable of being rapidly revolved, so as to store considerable rotational momentum therein,

2

and releasable after a power-application interval to develop axial thrust to propel the toy with which it is associated through the air as long as the said rotational momentum persists. Such toys make common use of a launching means comprising an extended screw which may be constructed in one of several familiar ways to provide long-lead threads engaged with a similarly threaded hub or rotor carried by the flight rotor. Flight in the toy is effected by relatively engaging the launching screw and the flight rotor hub, bringing the toy toward a starting position near one end of the screw and exerting physical effort so as to suddenly cause rapid movement of the toy along the screw toward its opposite end where it leaves the screw and thereafter continues free flight partly due to its forward momentum but in a greater measure to the thrust of the spinning flight rotor. Flight in the toy will be maintained as long as the rotational momentum of the rotor, and its thrust, persists. In such devices, two principal deficiencies exist. In the first place, a single spinning rotor will create a reversed twisting force in the toy plane and will cause the latter to veer to one side or the other depending on the direction of rotor movement and this will, unless counterbalancing in the weight of the plane is provided to overcome it or unless aerodynamic compensation therefor is effected in the flight direction control surfaces, prevent any predictable and accurate flight of the toy. In the second instance, the same twisting force which exists from the instant that launching force is applied to the toy may be so severe during launching that severe strain or structural damage may be inflicted in the toy.

We have provided a toy overcoming the above-mentioned objections. In Figure 1, we have shown, as an example, a model airplane comprising a fuselage 6 equipped with the usual main wing 7, stabilizers 8 and usual rudder 9. Secured to and extending chordally across each section of the main wing 7 is a pair of tubular bearings 11 each having a tubular shaft 12 journaled therein, to the forward end of which is attached a flight rotor 13 and to the rear end of which is secured a collar 14 which, together with the flight rotor, prevents movement of the shaft 12, beyond a limited amount, axially of the bearing 11. The respective flight rotors in this instance and for the sake of illustration are of right and left hand pitch and are thus capable of cooperative action only when relatively rotated counter to each other. Although it is preferable to provide rotors designed for counter rotation,

which produce desirable flight characteristics in the toy, satisfactory operation may be achieved if the rotors are both arranged to produce forward thrust when rotated in the same direction. All parts of the model including the bearings 11, the shafts 12 and the flight rotors 13 may be made of light material such as balsa wood, plastics, or light weight metals. A wide choice of materials is available for the parts required to withstand wear or strain, all of which may be made of harder plastic, or the shafts and bearings may be constructed of aluminum tubing and the flight rotors of wood which, of course, will be of a heavier type than balsa so as to lend structural strength to these members and to provide the necessary weight to extend momentum therein. In furthering this, each rotor blade 16 may be cut away in the portion thereof adjacent the hub 17 to form comparatively slender arms 18 and to locate as much of the weight of each blade as possible in the vicinity of its tip, or, the blades may be made progressively thicker, in a direction axially of the rotor, as they approach their tips. Four blades are also preferably provided in each flight rotor in order to add to the flywheel effect thereof. The flight stability of the toy will not be adversely affected by this construction, however, as the portions of the bearings 11 and shafts 12 extending rearwardly from the propellers will form a compensating counterweight sufficient to locate the center of gravity of the toy within the chordal limits of the wing 7.

Means is provided for launching the toy by causing its movement along a prescribed path in which the flight rotors 13 are caused to rotate at comparatively high speed so as to build up therein considerable rotational momentum which, when the toy is released from the launching device, will cause extended free flight of the toy. The launcher, which is a manually operated device, comprises a tie bar 19, preferably constructed of rigid material such as wood, metal or plastic, to which is attached a handle or grip 21, both the latter and the tie bar being bored to receive a sliding rod 22 fitted at its lower end with an operating handle 23. Secured in bores 24, paralleling the rod 22 and spaced apart longitudinally of the tie bar a distance equal to the center to center spacing between the propeller shafts 12, is a pair of combined guide rods and screws 26 each being formed of a length of twisted square or flat rod or wires twisted to form spiral flutes 27 one of which, on each screw, is slidably engageable by a protuberance 28 projecting radially inwardly from the wall of each rotor shaft 12 or by a shaped bore portion of the sleeve which is complementary to the cross-sectional form of the particular screw employed, through which the respective screws pass. It will be noted that this arrangement of the parts will cause spinning of the rotor shafts when the toy is moved longitudinally of the screws due to the fact that the engaging portions of the sleeve 28 will follow the spirals of the screw flutes with which they are associated. It will also be noted that in the drawings the screws are shown as twisted in opposite directions so as to cause relatively counter rotation of the flight rotors. However, it has been found that, due to the twin rotor construction which offers considerable resistance to counter-rotation of the toy bodily about the rotational axis of either rotor, reasonably satisfactory operation of the toy of our invention may be obtained with screws arranged to spin the rotors in the same direction. Also, it has been found to be advantageous to graduate the screws, that is to start from the anchored end of the screw with a helix which is at a relatively slight acute angle with the screw axis and to gradually increase the helix angle toward the free end of the screw. This will provide, independently of the force of movement of the toy along the screws, for acceleration of the rotors and will effect a maximum rotative speed therein at the instant that the toy is released from the launcher.

Means is provided for moving the toy along the screws so as to effect simultaneous rotation of the propellers and to launch the toy for flight into the air. Secured by collars 29 or by other suitable means fixed to the rod 22 is a rigid cross head 31 carrying a pair of fixed, relatively spaced sleeves 32 which are, respectively, concentric with the screws 26 and which extend therealong from the forward side of the crosshead. The extended ends of the sleeves engage the adjacent or rear ends of the rotor shafts 12 and the degree of extension of the sleeves is such that the rear portions of the toy such as the fuselage, stabilizers and rudder will clear the crosshead. In launching the toy, the cross-head is moved, as viewed in Figure 1, downwardly until it lies against the upper side of the tie bar 19. The screws 26 are then inserted into the rotor shafts 12 from the bottom ends of the latter and the toy is moved along the screws until the bottom ends of the shafts 12 engage the sleeves 32. Gripping the handles 21 and 23 in his respective hands, the user points the launcher in the direction of the desired line of flight and very suddenly and with considerable force moves the handles toward each other. This causes the crosshead 31 to slide axially along the screws pushing the toy before it until the latter is projected from the ends of the screws. During the interval of movement along the screws the flight rotors 13 will be rapidly rotated so that when the toy is freed the momentum stored in the spinning rotors will function to create extended forward thrust and flight in the toy which will persist in gradually diminishing degree during the period in which the momentum is being dissipated. At this point it should be brought out that the permissible stroke between the handles 21 and 23 should be such that the upper ends of the sleeves 32 will, at the end of the launching stroke, extend slightly beyond the outer ends of the screws 26 so that the toy is fully cleared from the screws and a slight additional push is imparted thereto by the added forward travel of the crosshead. One important result of the launching operation is that the respective flight rotors are revolved in absolute synchronism and with equal rotational force so that the thrust of one will be equal to the other thus producing flight stability in the toy and reducing to a minimum any veering thereof to either side of a comparatively straight line of flight. The extent of flight of the toy will of course be governed by the physical effort put into the operation of the launcher and the suddenness with which the respective handles are brought together. Normally, such an application of sudden thrust to a single screw launcher will create sufficient reactionary torque in the toy body as to cause destructive strains therein or actual breakage of parts. In the present launcher, the effect of the dual spiralled screws is to establish means whereby torque is mainly imposed on the flight rotors and their shafts and very little is transmitted to the toy body.

Therefore, regardless of the physical effort put into the launching operation, the danger of resulting damage occurring in the body parts is minimized.

In Figures 3 and 4 is illustrated a helicopter-type toy embodying the principles of the invention. In this modification, the body of the toy may comprise, for example, a skeleton frame having an upper spreader 33 and a relatively spaced lower spreader 34 joined together by a vertically extending spacer 36 which, for appearance sake, may be shaped as an airplane fuselage. Other customary parts, such as a rudder and landing gear may also be included in the structure to insure smoothness and stability in ascent, flight, descent and landing. Provided at the opposite ends of the upper and lower spreaders 33 and 34 are pairs of vertically aligned bearings 37 and 38 which journal the tubular shafts 39 on which the flight rotors 41 are secured. Collars 42 secured on the shafts 39 prevent axial movement of the latter downwardly relative to the spreader 34, and protuberances 43, or portions of the sleeves shaped complementarily with the cross-sectional form of the screws, in each shaft serve to effect operative engagement of the latter with the screws of the launcher. The launcher for this type of toy may be identical with or similar to that previously described in connection with the airplane type.

The launching of the helicopter type toy is of course directed along a substantially vertical line of flight along which the toy will soar to a height depending upon the amount of physical effort that has been exerted in the operation of projecting the toy into the air. When the top limit of flight has been reached and gravity acts upon the toy to start its return to earth, the flight rotors 41 will then whirl in counter-rotation to their direction of movement during ascent of the toy, to serve as sustaining airfoils to considerably arrest by their windmilling action the otherwise free and rapid descent of the toy. In this respect, the design of the helicopter flight rotors differs somewhat from that of the airplane type toy in that sufficient weight is built into the blades to give them the desired momentum but they are made sufficiently light so that the aforementioned free rotation or windmilling of the blades will not be impeded. In other words, an aerodynamic compromise is arrived at so that satisfactory ascent and descent of the toy are obtained.

We claim:

1. In combination, a flying toy comprising a body, a plurality of air screws mounted for independent rotation on said body, and a launcher comprising a plurality of fluted screw members each being releasably engageable with a respective air screw, means in each air screw engageable in a flute of a screw member for rotating the air screw when the latter is moved along said screw member, and means engaging said air screws for simultaneously moving the latter along said screw members.

2. In combination, a flying toy comprising a body, a plurality of flight rotors journaled on said body, a pair of screw members operatively connected with said flight rotors and along which said toy may be moved to impart rotation to said flight rotors, a crosshead slidably engaged with said screw members and releasably contacting said toy and manually operable means for moving said crosshead and the toy contacted thereby along said screw members.

3. In combination, a flying toy comprising a body, a plurality of multi-bladed flight rotors of opposite pitch journaled for free and independent rotation on said body, a plurality of helically fluted screw members of opposite pitch operatively and releasably engageable with said flight rotors and along which said toy may be moved, key means associated with each flight rotor slidably engaged in the spiral flute of its associated screw member for imparting to said flight rotor, when the toy is moved along the screw members, rotation corresponding to the path of said key means along the screw member flute, a crosshead slidably engaged with said screw members and contacting said toy, operating handles connected, respectively, with the screw members and said crosshead for moving the latter and the toy contacted thereby along the screw members, and said flight rotors each having blade portions thereof materially heavier than other portions whereby a preponderance of blade weight will be concentrated adjacent the blade tips.

4. In a flying toy including a plurality of flight rotors each provided with tubular hub portions arranged for relative rotational engagement with a helically threaded member, a launcher releasably associated with said toy comprising a plurality of said helically threaded members along which said flight rotors may be simultaneously moved, a crosshead slidably engaged with said threaded members and contacting said toy, and operating handles connected, respectively, with the threaded members and said crosshead for moving the latter and the toy contacted thereby along the threaded members.

ROBERT L. McMULLEN.
KENNETH C. GORDON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,859,805	Sleeper	May 24, 1932
2,035,531	Butcher	Mar. 31, 1936
2,035,629	Wing	Mar. 31, 1936

FOREIGN PATENTS

Number	Country	Date
627,212	France	May 30, 1927