United States Patent

[11] 3,589,059

[72] Inventor **Craig Vaughn Caswell**
740 Evergreen Road, Severn, Md. 21144

[21] Appl. No **883,075**
[22] Filed **Dec. 8, 1969**
[45] Patented **June 29, 1971**

[54] **ROTARY ACCELERATOR FOR TOYS**
2 Claims, 13 Drawing Figs.

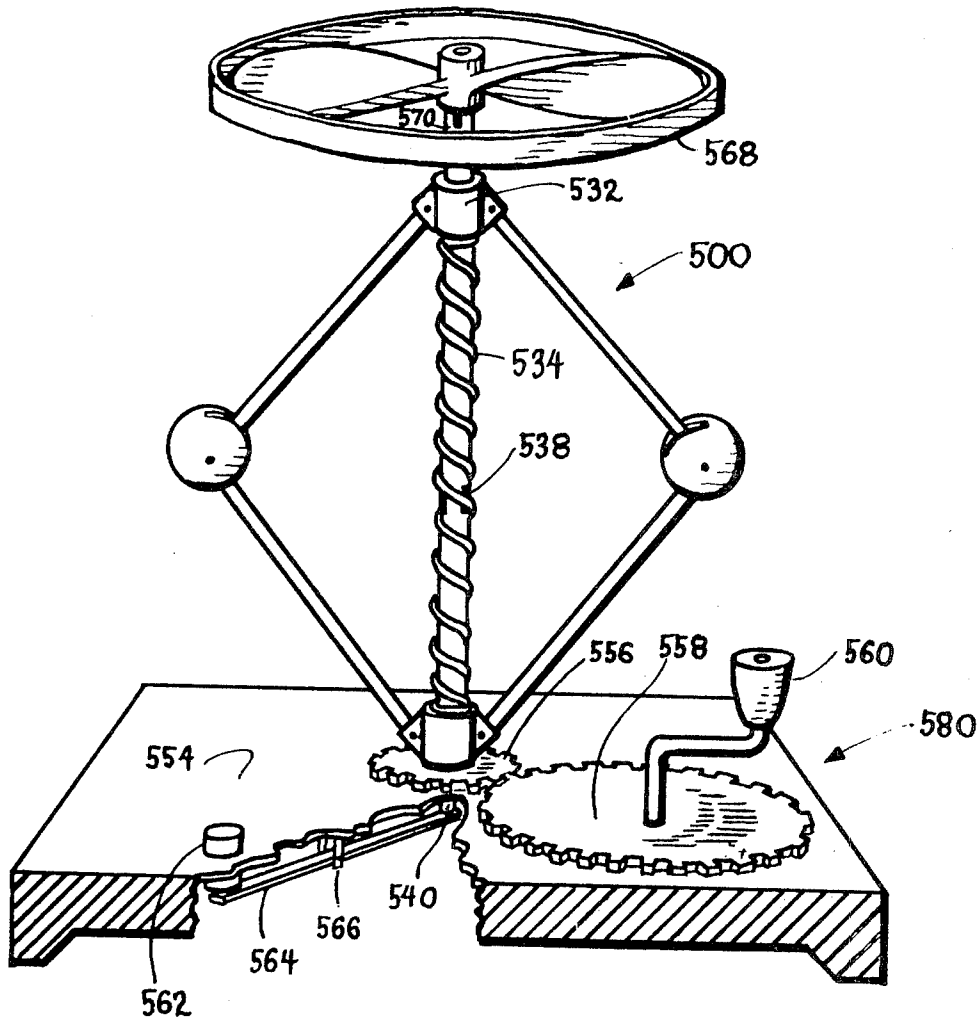
[52] **U.S. Cl.** **46/82, 124/16**
[51] **Int. Cl.** **A63h 27/00**
[50] **Field of Search** 46/82, 83, 84, 69; 124/11, 16; 273/49; 74/89.1

[56] **References Cited**
UNITED STATES PATENTS

85,874	1/1869	Tilden	46/82 X
3,364,787	1/1968	Miller	273/49 X

Primary Examiner—Louis G. Mancene
Assistant Examiner—D. L. Weinhold
Attorney—John F. McClellan, Sr.

ABSTRACT: A spindle mounted rotational accelerator for toys comprising typically, inertial masses for orbiting the spindle on symmetrically variable arms, a spring adapted to force the masses to move inward to accelerate rotation of the spindle, a sliding member advanced along the spindle by the arm concurrently with the inward motion of the masses, means to drive a toy disposed in the path of the advancing sliding member for release by the sliding member, and a latch to restrain the spring from forcing the masses inward.



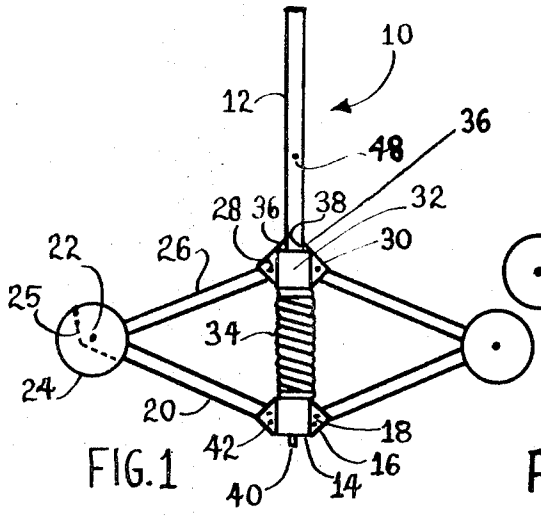


FIG. 1

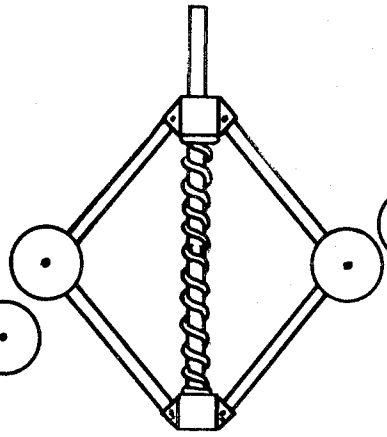


FIG. 2

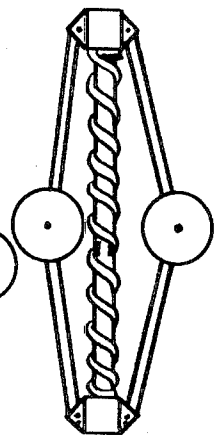


FIG. 3

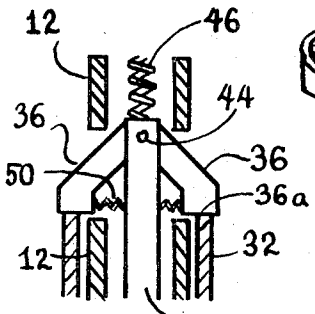


FIG. 4

FIG. 5

INVENTOR.
CRAIG V. CASWELL
BY
John F. McClellan, Jr
ATTORNEY

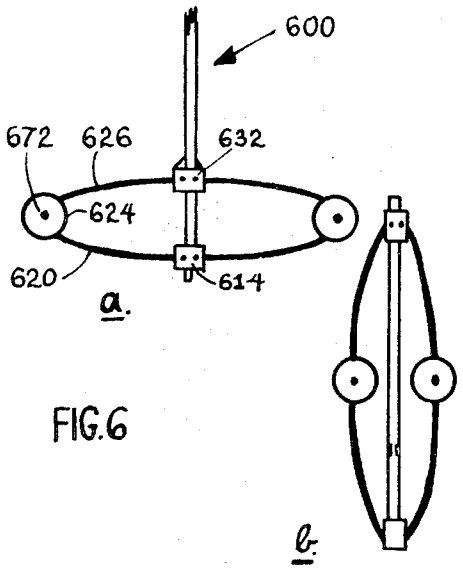


FIG.6

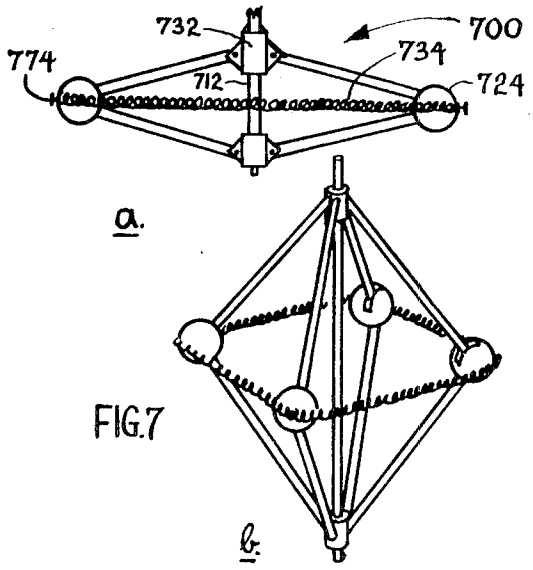
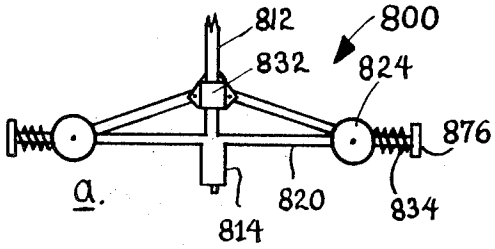


FIG.7



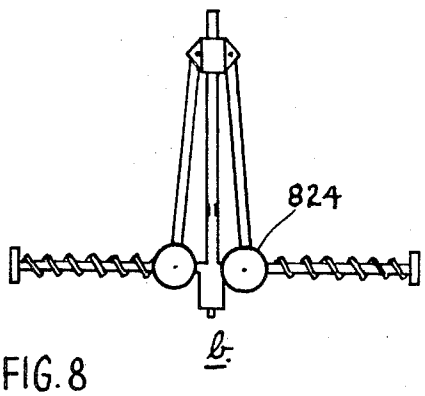


FIG.8

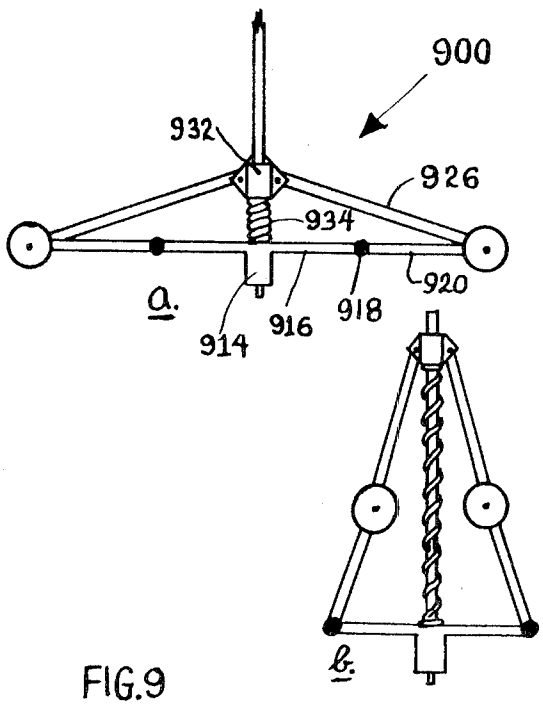


FIG.9

INVENTOR.
CRAIG V. CASWELL
BY John F. McClellan Sr.
ATTORNEY

ROTARY ACCELERATOR FOR TOYS

This invention relates generally to mechanical actuators for toys and particularly to rotary actuators for giving toys an initail impulse.

It is a principal object of this invention to provide a rotary actuator for toys which accelerates toys in a new and more efficient way than has been previously known, which if desired, automatically releases on reaching the highest speed of revolution, and which at the same time instructs the user in the laws of motion.

Many kinds of toys use power drives, usually spring powered, or motor powered, to give the toys an initial impulse.

Typically, mechanisms presently used to drive toys accelerate inefficiently. Typically also, they teach the user little or nothing about the laws of physics because the devices operate practically instantaneously, sometimes unpredictably, and because the supporting structure usually conceals the principles of operation of the mechanism. Furthermore many of the mechanisms previously available to toy manufactures closely limit the driven member in size and weight because unprogrammed accelerators suit only one combination of size and weight, and usually do not couple efficiently to all types of mechanism.

Additional objects of this invention therefore are to provide a rotary actuator as described which operates predictably and programs acceleration in several modes, which instructs the user in the laws of motion both visually and audibly, which adapts readily to a great variety of driven toys, and which couples efficiently to all types of mechanism.

Further important objects of this invention are to provide a rotary actuator as described which operates safely and well in any orientation, and which in every one of the various embodiments offers an attractive product for low-cost mass production and distribution.

In a representative embodiment this device includes a group of masses symmetrically disposed about a rotatable spindle on joined, pivoted arms; one joined, pivoted end of the arms is urged toward and along the spindle by a spring; a trigger released latch restrains the spring. The other joined, pivoted end of the arms is secured to the spindle.

The above objects and advantages of this invention will become more apparent on examination of the following description, and the drawings in which:

FIGS. **1**, **2** and **3** show in side elevation, details of an embodiment of this invention in three positions of operation;

FIG. **4** shows a vertical section of a latch detail;

FIG. **5** shows, in perspective, an embodiment of this invention having a portion broken away to display structure;

FIG. **6** shows, in side elevation, details of a second embodiment of this invention in two positions of operation;

FIG. **7** shows, in side elevation and in perspective view, details of a third embodiment of this invention in two positions of operation;

FIG. **8** shows, in side elevation, details of a fourth embodiment of this invention in two positions of operation; and

FIG. **9** shows, in side elevation, details of a fifth embodiment of this invention in two positions of operation.

Referring now to FIGS. **1**, **2** and **3**, the structural details of embodiment **10** of this invention begin with spindle **12**, a cylindrical tube. Clamp **14**, affixed to the lower end of the spindle has integral flanges **16** which mount pins **18**. The pins pivotally attach lower arms **20** to the spindle. A second set of pins **22** fixes slotted masses **24** to the lower arms, and pivotally attaches upper arms **26** to the lower arms. The slots **25** in the masses provide room for passage of the arms. The upper ends of arms **26** pivotally attach through pins **28** to flanges **30** of sliding bushing **32**. Spring **34** mounted on the spindle **12** and compressed between the clamp **14** and the sliding bushing **32**, urges the sliding bushing upward. Latch halves **36** protrude outwardly through slots **38** in the wall of spindle **12** and restrain the sliding bushing against sliding up in response to the spring force. Trigger rod **40**, shown protruding below the spindle, passes upward through the bore of the spindle and engages the latch halves in a linkage relation which releases the latch when the trigger rod is moved upward, as will appear later, in FIG. **4**.

To prepare the actuator for operation, the user forces the sliding bushing downward, compressing the spring until the latch engages the top of the bushing and holds the spring compressed.

The user then spins the actuator about the axis of the spindle. The exact method and apparatus used to spin the actuator will depend on the device associated with the actuator. A typical device for spinning the actuator will be discussed below in reference to FIG. **5**.

After the actuator reaches the desired initial speed of rotation, the user forces the trigger rod upward to release the latch.

Immediately on release, the spring urges the sliding bushing upward, resisted by the centrifugal force of the masses, which force tends to pull the bushing downward and force the masses outward, in opposition to the spring.

The spring-constant of the spring is chosen to be great enough to overcome the opposing force of the masses at the particular speed of rotation at the moment of release, and to cause the sliding bushing to move upward. As the bushing moves upward, the arms foreshorten and draw the masses inward toward the spindle, accelerating the rotational speed of the spindle through conservation of angular momentum.

Although the spring force and the mechanical advantage of the spring linkage decrease as the spring extends, a properly strong spring continues to accelerate the spindle smoothly through intermediate positions as in FIG. **2**, reaching a high order of magnitude of spindle speed at the limit of travel shown in FIG. **3** as compared with the initial spindle speed. The extreme limit of travel may usefully allow the bushing to overlap the upper end of spindle **12**, as will be seen. Contact of the masses with the spindle can be used to limit the travel.

One or more whistle-holes **42**, FIGS. **1**—**3**, provide audible indication by pitch change of the magnitude and rate of the increase of spindle speed during operation of the device.

For the embodiments of FIGS. **1**—**3**, as in the following embodiments, the springs may be made of spring steel, and the remaining parts may be made of mild steel or structural plastic.

FIG. **4** shows, in section, a detail of the latch. Latch halves **36**, pivotally joined to each other and to trigger rod **40** by pin **44**, retract from the position shown and pivot together within spindle **12** when the trigger rod is forced upward. When the latch halves retract, the lower ends **36***a* release sliding bushing **32** to move upward past the latch.

Compression spring **46**, retained at the upper end against a pin (**48**, FIG. **1**) presses downward in the spindle against the upper end of trigger rod **40** and resets the latch in conjunction with twin springs **50** which resist retraction by pressing against the trigger rod and urging the latch halves outward. Springs **50** seat in recesses (not shown) at each end of the springs.

FIG. **5** shows the FIG. **1** actuator embodied in a toy **580**, to illustrate one application of the device. The toy consists of a base and rotator, and a free flying propeller, at opposite ends of the actuator.

Base **554** rotatively supports driven gear **556** by means of a hole (not shown) below the gear, which journals the gear hub (not shown). The base supports drive gear **558** in the same way. Preferably, both journals include antifriction bearings.

Manual rotation of crank **560** causes drive gear **558** to rotate driven gear **556** and actuator assembly **500**. As mentioned earlier, when the actuator assembly reaches the desired initial speed of rotation, the user moves the trigger rod upward, retracting the latch and releasing the spring.

In the FIG. **5** assembly, downward pressure on plunger **562** pivots lever **564** about fulcrum **566** and moves trigger rod **540** upward to retract the latch through slots **538**, releasing sliding bushing **532** and spring **534**. The rotating assembly then smoothly accelerates the driven device, in this case propeller

568, driving through a coupling between the spindle and the propeller, as through any ordinary spline or key, 570. As the sliding bushing 532 reaches the limit of travel, it lifts the propeller hub, freeing the propeller to rise just at the instant the spindle provides peak rotational speed.

FIGS. 6*a* and 6*b* show the latched and unlatched positions of an embodiment similar to the FIG. 1 embodiment, except that the arms 620 and 626 on each side are a continuous effectively U-shaped, compression spring, substituting for the coil spring of FIG. 1. The springs pivot in clamp 614 and sliding bushing 632. Masses 624 are clamped to the springs, as by screws 672. This embodiment requires the fewest number of parts and relatively few manufacturing operations.

FIGS. 7*a* and 7*b* show a further embodiment of this invention in two positions of operation. In this embodiment coil tension spring 734 encompasses the masses 724 and draws them directly toward the spindle 712, so that the ratio of advance of bushing 732 to orbiting radius of the masses remains the same as in the previous embodiments, but the spring has more nearly constant mechanical advantages.

Screws 774 fasten the spring to the masses. As FIG. 7*b* indicates, this and the other embodiments may employ more than two masses, with the masses symmetrically disposed to assure dynamic balance.

FIGS. 8*a* and 8*b* disclose another embodiment of this invention, in two positions of operation. Here, the masses 824 travel radially, sliding on arms 820 which radiate from spindle 812 to which clamp 814 affixes the arms. Each arm 820 has an integral cap 876 at the outer end. The caps retain compression springs 834 on the arms, and the retained springs urge the respective masses 824 directly inwardly toward the spindle. Note that in this embodiment the masses do not rise or fall with respect to the length of the actuator, and that sliding bushing 832 advances only one-half the distance it advanced in prior embodiments during the reduction in radius from the spindle to the masses.

In this embodiment, clamp 814 has a downward elongation providing a gripping surface for easier installation of the actuator in toys. Other versions of this invention can have the same feature, if desired.

FIGS. 9*a* and 9*b* show two positions of yet another embodiment, which provides another unique combination of radius arm, slide bushing travel and mechanical advantage for the spring.

The lower arms 920 in this embodiment pivot at 918 at the ends of extended arms or flanges 916 fixed to clamp 914.

The fixed flanges extend radially a distance approximating the length of the lower arms 920. Upper arms 926 extend somewhat more than the combined lengths of the fixed flanges and lower arms.

In operation, sliding bushing 932 advances proportionately more than in the FIG. 8 embodiment and less than in the embodiments of FIGS. 1—7.

Spring 934 urges the sliding bushing away from the clamp as in the FIG. 1 embodiment, but under a different program of mechanical advantage, requiring a stronger spring.

It will be appreciated from the above description that the actuator of this invention will drive a wide variety of toy types, weights, and sizes, with little or no modification. The latch-controlled provisions for energy storage, in combination with the programmed change in mechanical relations on release of the latch, make performance of this actuator less dependent on the characteristics of the driven toy than in previous toy drives, and at the same time more efficient and more interesting, and instructive.

In summary, the superrevolution actuator for toys (which is tentatively named "SUPER-REV" as a trade name) can be applied to any top which requires rapid circular motion. It can be attached to the simplest flying disc as illustrated, or it can be adapted to drive toy boats or cars, accelerating smoothly and automatically releasing at the very peak r.p.m. Incorporated in a toy car and attached to a time release gear it will produce a sudden surge while the car is in motion, giving the effect of a race car shifting gears and jumping forward. For example a small "SUPER-REV" built into a slot car and adapted to release on passing over a magnet will cause the car to jump ahead of competing cars when the actuator is released.

Obviously many modifications of the present invention are possible in the light of the above teachings. For example, the latch mechanism described may be varied in type or in location, and can restrain one or more of the masses directly from moving upward or inward, as the case may be.

It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A rotary actuator for toys comprising: spindle means, lower arm means attached at one end to the spindle means, sliding means on the spindle means, upper arm means movably attached at one end to the sliding means, mass means movably supported by all said arm means in radial relation to the spindle means, spring means for moving the mass means toward the spindle means, and latch means for restraining movement of the mass means towards the spindle means, the spindle means being tubular and having a slot intermediate the ends thereof, the upper arm means being pivotally attached at said one end to the sliding means, the mass means being pivotally attached to the other end of the upper arm means, the latch means including means for protruding through the spindle slot and restraining the sliding means, a portion of said sliding means traveling proximate an end of the spindle at the limit of said movement of the mass means towards the spindle means by the spring means, said proximate end of the spindle having means adapted for rotationally driving a toy, the lower arm means being pivotally attached a tone end to the spindle means and attached at the other end to the mass means, said spring means including a compression spiral spring encircling the spindle means between said lower arm means attachment and the sliding means, the actuator having means for rotating said actuator attached at one end of the spindle means, and free-flying toy means removably attached to the opposite end of the spindle means within the limit of travel of the sliding means, whereby the sliding means is adapted to detach the free-flying toy means from the spindle means by contact therewith during said travel of the sliding means.

2. A rotary actuator for toys as recited in claim 1, wherein the means for rotating said actuator comprises a base having bearing means for supporting the actuator gear means, and latch actuation means including a plunger and a pivoted lever having an end in contact with the plunger; and rod means extending downward form the spindle in position for actuation by the lever and extending upward in the spindle in position for actuating said protruding latch means.