United States Patent

[11] 3,617,056

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[21] Appl. No. **12,273**
[22] Filed **Feb. 18, 1970**
[45] Patented **Nov. 2, 1971**
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[54] **INERTIA STARTER DUMBBELL EXERCISING SYSTEM**
4 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **272/84,** 74/6, 46/50
[51] **Int. Cl.** **A63b 11/06,** A63b 11/04
[50] **Field of Search** 272/84, 57; 74/6; 46/50

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

1,250,266 12/1917 Banks 46/50
3,365,835 1/1968 Grow 46/50

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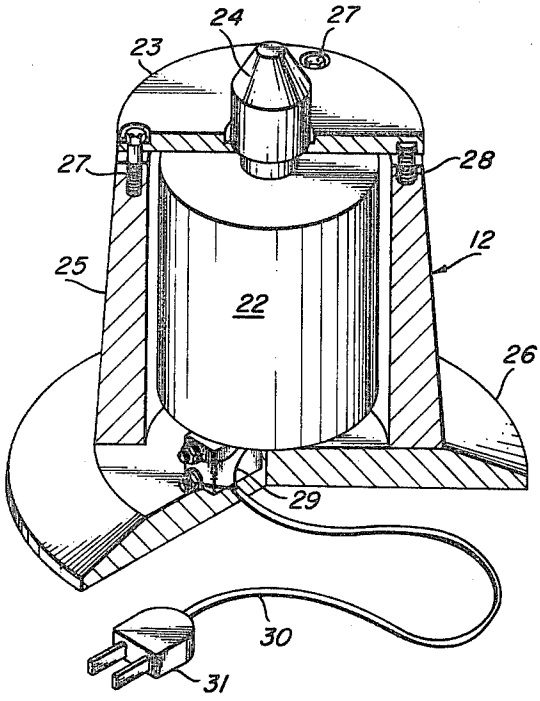
ABSTRACT: An exercising device provided which utilizes the precession effect exhibited by masses rotating at a relatively high angular velocity to resist changes in orientation of the axis of rotation. The device contains only the inertial elements which utilize a separate electric motor unit to accelerate the mass, the inertia of which provides the desired effect for several minutes after which it may again easily be accelerated for further use. The acceleration of the mass is accomplished by a clutch on the end of the electric motor shaft which is removably engageable with a rotatably mounted shaft which has the masses mounted thereon. Once the shaft and the mass has been caused to rotate at the required speed the clutch is disengaged from the rotating shaft. The shaft and the masses are rotatably mounted in a housing with a handgrip portion.



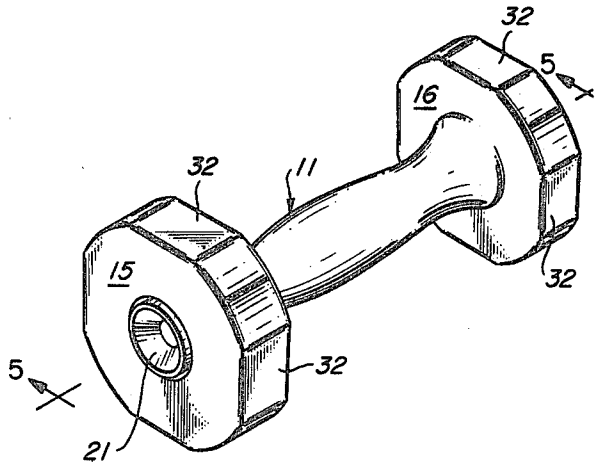


Fig. 4

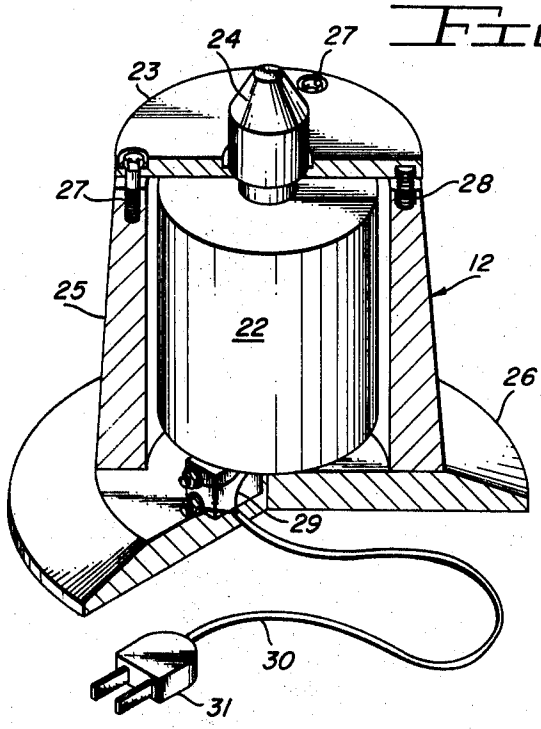
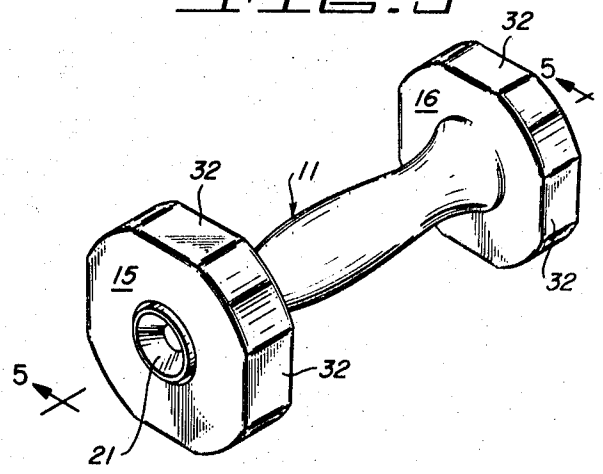


Fig. 3



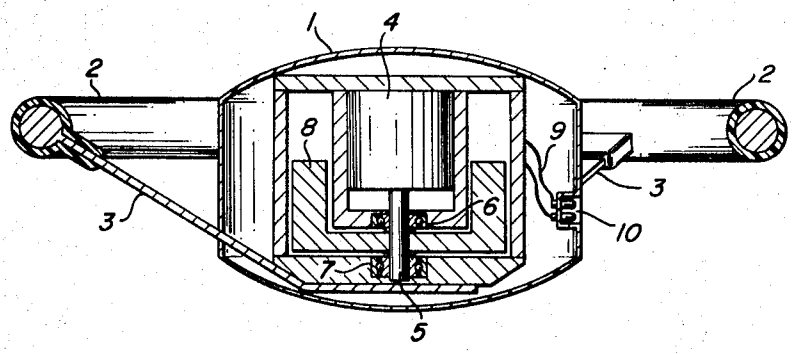


Fig. 2

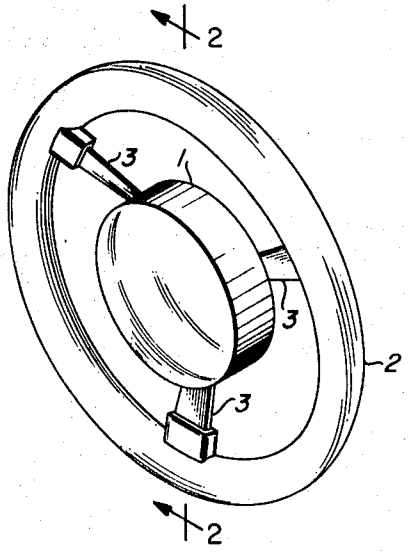


Fig. 1

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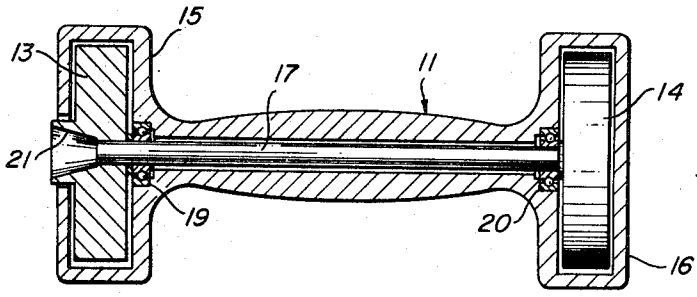


Fig. 5

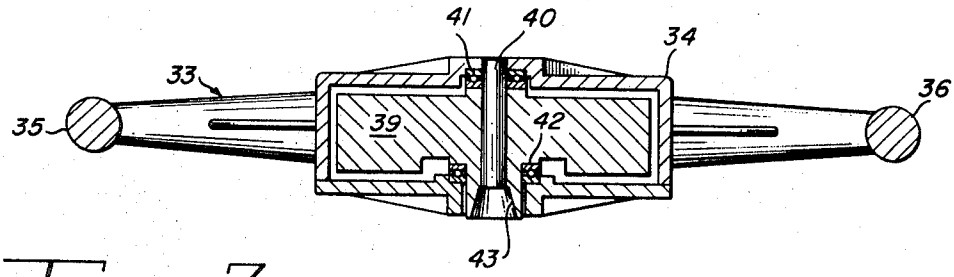
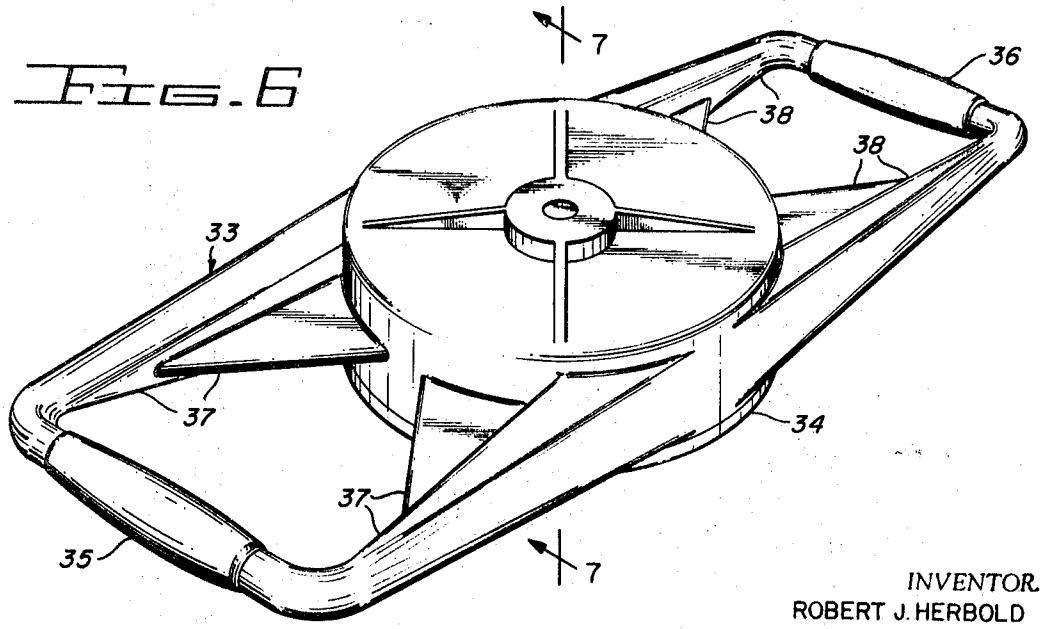


Fig. 7

Fig. 6



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INERTIA STARTER DUMBBELL EXERCISING SYSTEM

This invention relates to an exercise device which utilizes the precession effect of rotating bodies to resist displacement in position of its axis of rotation.

In the preponderance of exercise devices, the sought after exercise is accomplished by resisting a force natural to the exercise device, which force is inherently unidirectional. For example, exercise utilizing weights simply consists of overcoming the force of gravity, which force corresponds to the size of weight utilized. While pulley systems can translate the direction of the gravitational force, the resistive force remains fundamentally unidirectional. The same objection may be raised with respect to exercise devices which depend upon springs for exerting a force against which one strives. Further, it may be noted in the case of weights, that the force is constant although the power required to move the weight bears a relationship to the rate of movement. Similarly, spring-loaded exercise devices exert reasonably constant resistance to change in position within their nominal range of operation. It may therefore be observed that an additional dimension may be realized by providing an exercise device in which there is a resistance to change of position in most directions, which resistance to change increases with he effort directed toward effecting the change.

It is therefore a broad object of this invention to provide an improved physical exercise system.

It is a more specific object of this invention to provide a physical exercise system which utilizes resistance to change in position, which resistance increases with a corresponding increase in the effort exerted to bring about the change.

It is a still more specific object of this invention to provide an exercise system utilizing a device which takes advantage of the precession effect of rotating masses.

It is yet another specific object of this invention to provide a device operating in conjunction with the force of gravity.

The manner in which these and other objects of the invention are achieved will become more readily apparent to those conversant in the art from a perusal of the following specification taken in conjunction with the adjoined claims and figures of which:

FIG. 1 is a perspective view of a self-contained exercise device embodying the present invention;

FIG. 2 is a cross-sectional view taken along the lines 2—2 of FIG. 1 to illustrate the internal structure of the exercise device of FIG. 1;

FIG. 3 is a perspective view of a dumbbell exercise device constructed in accordance with another embodiment of the present invention;

FIG. 4 is a partially cutaway view of an accessory energizing unit for imparting angular momentum to rotating elements within the device illustrated in FIG. 3;

FIG. 5 is a cross-sectional view taken along the line 5—5 of FIG. 3 illustrating the internal structure of the dumbbell exercise device;

FIG. 6 is a perspective view of another exercise device which utilizes the unit illustrated in FIG. 4 for bringing a mass contained within its central structure to an angular velocity sufficient to exhibit pronounced precession; and

FIG. 7 is a cross-sectional view of the FIG. 6 device showing the internal structure thereof.

Referring now to FIGS. 1 and 2, an embodiment of the instant invention is illustrated in which the mechanism, including the motive power source, is disposed within a central housing 1 arranged concentrically within a circular handgrip 2. The relative placement of the housing 1 with respect to the handgrip 2 is rigidly maintained by a plurality of spokes 3.

Referring now specifically to FIG. 2, it will be observed that an electric motor 4 is fixed concentrically within the housing 1. The electric motor 4 is provided with an axially extending output shaft 5 journaled in ball bearings 6 and 7. A massive weight 8 is fixed to the shaft 5 between the bearings 6 and 7. A massive weight 8 is fixed to the shaft 5 between the bearings 6 and 7 such that the shaft 5 provides support for the weight 8 while permitting it free rotation. The rotating system, comprising the rotating elements of the electric motor 4, the shaft 5, and the massive weight 8, are dynamically balanced with respect to the axis of rotation such that relatively high angular velocities can be achieved and maintained without experiencing undue vibration. The electric motor 4 is energized from ordinary household current through conductors 9 which terminate in a plug 10 for coupling to a wall plug through a suitable cord (not shown).

In operation, the electric motor 4 is energized by coupling the plug 10 to a wall socket in the usual manner. The rotating system, including the massive weight 8 then commences to rotate and acceleration continues until an angular velocity is established at which the electric motor is capable of making up losses but incapable of further acceleration. This terminal velocity can be established within the tolerance necessary by properly relating the mass of the weight 8 to the output power capabilities of the electric motor 4 and by adjusting other parameters in the manner well known in the motor arts. It has been found that a terminal velocity of approximately 10,000 r.p.m. produces sufficiently pronounced precession to achieve the desired object although higher speeds may easily be attained without danger if the rotating system is properly dynamically balanced. It may be noted that a good static balance has been demonstrated to provide satisfactory dynamic operation within the angular velocities contemplated.

Once the desired angular velocity has been attained, it may be either maintained by simply continuing to apply the energizing power to the electric motor 4, or the cord (not shown) may be detached from the plug 10 for cordless operation during which the momentum of the rotating system maintains precession at a slightly decreasing rate corresponding to the decrease in angular velocity.

As the massive weight 8 rotates, the precession effect forcibly tends to resist any change in position of the axis of rotation. It will be observed that the configuration of the exercise device depicted in FIGS. 1 and 2 is such that if the circular handgrip 2 is grasped with both hands in the obvious manner and an attempt is made to move the exercise device in any direction other than a simple forward and backward motion directly along the axis of rotation, a decided force resisting the movement will be brought about. Hence, upward, downward and sideward movements and combinations thereof are resisted much like the upward movement of ordinary weights. While the weight of the exercise device is, of course, a factor in the resistance to movement in the several directions, the use of relatively high angular velocities

Those skilled in the art will recognize that the power necessary to sustain a given velocity is, within limits excepting extremely high angular velocity with correspondingly high frictional losses, very much less than the power required to accelerate the same mass to the nominal angular velocity. It will therefore be realized that it would be a simple matter to provide a battery power unit with means, such as a centrifugal switch, for shifting the source of energy for the electric motor 4 from the line to an integral battery pack. This may be achieved in a number of ways which are simply design options. For example, the line may energize the primary of a stepdown transformer within the housing 1 such that a much lower voltage may be utilized to drive the electric motor 4 which may then be of the common AC-DC type functioning at a voltage, for example, of 6 or 12 volts. The battery pack rating simply corresponds. As an additional adjunct, rechargeable batteries, such as the nickel-cadmium type, may be utilized in the battery pack in conjunction with a charger circuit to replenish the cells during acceleration and/or nonuse of the exercise device. Such arrangements, again, are simply matters of design.

FIG. 3 depicts another embodiment of the invention in which the traditional dumbbell exercise device 11, with a slightly modified exterior shape, contains a journaled massive weight for utilizing the previously discussed precession. The dumbbell 11, however, does not contain an integral source for imparting kinetic energy to the rotating mass but rather cooperates with the energizing unit 12 depicted in FIG. 4.

The internal construction of the dumbbell exercise device 11 may best be understood with reference to FIG. 5. First and second massive weight 13 and 14 are journaled for rotation with respective end portions 15 and 16 of the dumbbell 11 and are locked together by a shaft 17 extending through the handgrip portion of the dumbbell 11. The shaft 17 is supported for rotation by bearings 19 and 20 on the handgrip side of the respective massive weight 13 and 14. It will be understood that sufficient clearance is afforded the weights 13 and 14 and the shaft 17 for free rotation within the bearings 19 and 20 and that the bearings 19 and 20 are adequate to function as thrust bearings to accommodate the slight amount of axial play in the rotating assembly.

Referring now to both FIGS. 3 and 5, it will be observed that the first massive weight 13 is provided with a conical cavity 21 which is utilized in a church coupling to the energizing unit 12 of FIG. 4 as will be described in further detail below.

The energizing unit 12 illustrated in FIG. 4 is utilized to bring the rotating system of the dumbbell 11 to the desired angular velocity after which the momentum of the rotating system is utilized to bring about the precession effect as one exercises. The energizing unit 12 comprises an electric motor 22 secured to a cover plate 23 such that its output shaft projects upwardly through the cover plate. A conical clutch member 24 is fixed to the output shaft for engagement with the conical cavity 21 of the dumbbell 11. A generally cylindrical housing 25 encompasses the electric motor 22 and is supported by a base 26 which provides stability for the entire assembly.

The cover plate 23 is assembled to the housing 25 by means of a plurality of bolts 27 which mate with corresponding threaded borings in the top of the housing 25. The threaded borings are limited to depth such that the bolts 27 cannot be screwed entirely home. A plurality of springs 28 (one only shown in the cutaway view of FIG. 4) are arranged symmetrically about the upper periphery of the housing 25 in order to urge the cover plate 23 into a normal, spring-loaded, upwardly biased position against the underside of the heads of the bolts 27. The springs 28 seat in corresponding recesses provided both in the bottom of the cover plate 23 and the upper surface of the housing 25. Thus, it will be understood that the normal position of the cover plate 23 is that in which upward movement is limited by the heads of the bolts 27 and that moderate pressure exerted downwardly on the cover plate 23 will move the cover plate and motor 22 down until the cover plate 23 seats upon the upper edge of the housing 25.

A normally open switch 29, which may be of the well-known Microswitch type or an equivalent, is fixed to the base 26 with its actuating mechanism directed upwardly such that when the cover plate 23 and motor 22 assembly is pushed downwardly, the actuating mechanism is operated to close the contacts. The switch 29 is wired in series with one side of a power cord 30 to the motor 22; hence, closing the contacts of the switch 29 will result in the energization of the motor 22 provided the plug 31 is in communication with a suitable power source.

In operation, the dumbbell 11 is grasped and the conical cavity 21 is pushed downwardly upon the mating conical clutch member 24 to simultaneously depress the cover plate 23 and the motor 22 which actuates the switch 29 and energizes the motor. The motor then commences to rotate and the rotation is communicated to the massive rotating assembly within the dumbbell 11 through the clutch comprising the conical cavity 21 and the conical clutch member 24. The dumbbell 11 is held down against the energizing unit 12 until the desired angular velocity has been attained after which it may be used to exercise in a manner which takes advantage of the force of precession.

It has been found, in the case of the dumbbell exercise device 11, that it is desirable to have at least two sizes differing both in weight and angular momentum capacity to accommodate the various physical capabilities encountered within an average family. It has further been found desirable to provide a plurality of flat areas 32 on the end portions 15 and 16 of the dumbbell structure 11 to prevent the dumbbell from rolling, particularly when the rotating system is in motion.

FIGS. 6 and 7 depict yet another embodiment of the invention in which, like the dumbbell of FIGS. 3 and 5, angular momentum is imparted to a rotating mass by the energizing unit 12 of FIG. 4. As best shown in FIG. 6, the exercise device 33 generally comprises a centrally disposed housing 34 and outboard handgrips 35 and 36 fixed to the central housing by support structure 37 and 38. The internal structure of the exercise device 33 is straightforward and is best shown in FIG. 7. A massive weigh 39 is fixed to a shaft 40 for rotation within ball bearings 41 and 42. A conical cavity 43, corresponding to the conical cavity 21 of the dumbbell 11, mates with the conical clutch member 24 whereby angular momentum may be imparted to the rotating system of the exercise device 33 in a manner closely related to that utilized with the dumbbell exercise device 11. Once the desired angular velocity is attained, the exercise device 33 is used in a two-handed fashion in much the manner previously described in conjunction with the integrally powered exercise device depicted in FIGS. 1 and 2.

While the principles of the invention have now been made clear in an illustrative embodiment, there will be immediately obvious to those skilled in the art many modifications of structure, arrangement, proportions, the elements, materials, and components, used in the practice of the invention which are particularly adapted for specific environments and operating requirements without departing from those principles.

I claim:

1. An exercise system including:
   - A. a housing;
   - B. handle means secured to said housing;
   - C. a shaft;
   - D. a mass affixed to and circumferentially disposed about said shaft within said housing, said shaft and said mass being supported by bearings for rotation within said housing, said mass and said shaft being dynamically balanced about their axis of rotation, said mass and said shaft being of such a size and weight as to be manually movable during an exercise program; and
   - E. motive means for accelerating said mass to an angular velocity sufficient to impart pronounced precessional resistance to change in position of the axis of rotation of said mass and said shaft, said motive means being removably engageable with said shaft, and said mass comprising weights fixed to the respective ends of said shaft.

2. The exercise system of claim 1 in which said motive means comprises an electric motor disposed in an energizing unit housing, said electric motor being provided with an output shaft extending beyond said energizing unit housing, and means on the end of the electric motor shaft in the unit housing for temporarily coupling said motor output shaft to said mass.

3. The exercise system of claim 2 which includes switch means responsive to the temporary coupling between said motor output shaft and said mass for correspondingly temporarily energizing said electric motor.

4. The exercise system of claim 1 in which said weights are disposed in corresponding first and second portions of said housing, said handle means connecting said first and second portions of said housing.

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