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(54) **FRICTIONAL ENERGY ACCUMULATION AND ACCELERATION YO-YO**

(57) The present invention discloses a yo-yo ball with friction motion energy storage and acceleration functions, comprising two rotating bodies and a connecting shaft, where either of the rotating bodies includes a disk body and a side cover, either of the disk bodies is internally provided with a friction motion energy storage mechanism, one end of which is connected to the disk body and the other end is connected to the side cover, by pinching the side cover, the disk bodies are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism by means of friction rolling. After the energy storage, the disk bodies are out of contact with the external contact surface, and the friction motion energy storage mechanism releases the energy to drive the disk bodies to synchronously rotate, at the moment, the side cover is released to realize rotation of the whole yo-yo ball, so that the ball body can rotate at high speed after being thrown even though a rope is too short, which is not affected by an acceleration region after the ball body is thrown down. Therefore, even though a player who is shorter may enjoy playing with the yo-yo ball to the fullest, and complete various fancy moves. Requirements of players at different ages and different heights can be met. Compared with an existing yo-yo ball, the yo-yo ball with friction motion energy storage and acceleration functions increases a new operation mode and a new playing method, is more

fun, and more diversified in playing methods.

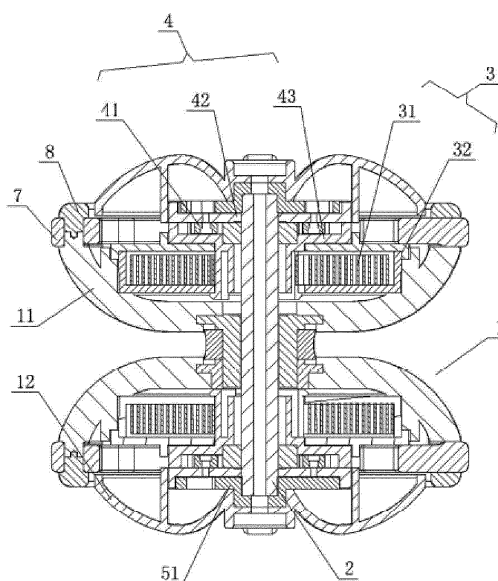


FIG. 2

Description

TECHNICAL FIELD

[0001] The present invention relates to a yo-yo ball, and particularly to a yo-yo ball with friction motion energy storage and acceleration functions.

BACKGROUND

[0002] In the current market, a yo-yo ball consists essentially of two rotating bodies and a connecting shaft connecting the two rotating bodies, then a rope entwines in the middle of the two rotating bodies. The yo-yo ball body is thrown down at full tilt so that the yo-yo ball body can rotate quickly at the end of the rope. However, limited by a recovery system and a bearing system of the yo-yo ball, a shorter user is unable to play by throwing down the yo-yo ball body by using a rope. This is because the length of the rope is in direct proportion to the height of the user. To a taller user, after the ball body is thrown down, there is enough acceleration region for the ball body to accelerate to a certain speed, to complete various fancy moves. However, to a shorter player, it is unable to complete a move because the acceleration region is too short after the ball body is thrown down and the rotational speed of the ball body is not fast enough.

SUMMARY OF THE UTILITY MODEL

[0003] An objective of the present invention is to solve the above problems, and to provide a yo-yo ball with friction motion energy storage and acceleration functions which is slickly designed, highly interesting and which can manually store energy.

[0004] The technical solution of the present invention is implemented as below:

[0005] A yo-yo ball with friction motion energy storage and acceleration functions, including two rotating bodies and a connecting shaft connecting the two rotating bodies, where either of the rotating bodies includes a disk body and a side cover, the disk body can rotate relatively to the side cover, either of the disk bodies is internally provided with a friction motion energy storage mechanism, one end of the friction motion energy storage mechanism is connected to the disk body and the other end is connected to the side cover, by pinching the side cover of the two rotating bodies, the disk bodies are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism by means of friction rolling; after the energy storage, the disk bodies are out of contact with the external contact surface, and the friction motion energy storage mechanism releases the energy to drive the two disk bodies to synchronously rotate towards a direction opposite to a rolling direction.

[0006] In order to reduce unnecessary loss of energy released by the friction motion energy storage mechanism,

in the present invention, either of the disk bodies is internally provided with a direction-limiting mechanism disposed in a position where the side cover is connected to the friction motion energy storage mechanism, one end of the direction-limiting mechanism is connected to the side cover, the other end is connected to the friction motion energy storage mechanism, a rotational direction limited by the direction-limiting mechanism is the same as an energy storage direction of the friction motion energy storage mechanism, by pinching the side cover of the two rotating bodies, the disk bodies are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism by means of friction rolling towards the rotational direction limited by the direction-limiting mechanism.

[0007] In order to prevent overloaded energy storage from damaging the friction motion energy storage mechanism, in the present invention, either of the disk bodies is internally provided with an overload protection mechanism disposed in a position where the side cover is connected to the friction motion energy storage mechanism, one end of the overload protection mechanism is connected to the side cover, the other end is connected to the friction motion energy storage mechanism; in case of overloaded energy storage for the friction motion energy storage mechanism by pinching the side cover, under the action of the overload protection mechanism, the side cover is disconnected from the friction motion energy storage mechanism, thereby realizing to stop energy storage for the friction motion energy storage mechanism.

[0008] In order to reduce unnecessary loss of energy released by the friction motion energy storage mechanism and to prevent overloaded energy storage from damaging the friction motion energy storage mechanism, in the present invention, either of the disk bodies is internally provided with a direction-limiting mechanism and an overload protection mechanism which are disposed in a position where the side cover is connected to the friction motion energy storage mechanism, one end of the direction-limiting mechanism is connected to the friction motion energy storage mechanism, the other end is connected to one end of the overload protection mechanism, the other end of the overload protection mechanism is connected to the side cover, a rotational direction limited by the direction-limiting mechanism is the same as an energy storage direction of the friction motion energy storage mechanism, by pinching the side cover of the two rotating bodies, the disk bodies are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism by means of friction rolling towards the rotational direction limited by the direction-limiting mechanism; in case of overloaded energy storage for the friction motion energy storage mechanism, under the action of the overload protection mechanism, the side cover is disconnected from the direction-limiting mechanism, thereby realizing to stop energy storage for the friction motion energy storage mechanism.

mechanism.

[0009] The direction-limiting mechanism may have multiple structural forms, and the direction-limiting mechanism in the present invention includes a plurality of direction-limiting blocks, a mounting disk in which all the direction-limiting blocks are mounted, and a gear disk which is concavely provided with internal helical gear teeth, where the direction-limiting blocks can be automatically rotatably connected, by means of pin bolts, to a bottom surface of the mounting disk and protrude above the mounting disk; the gear disk is covered on the direction-limiting blocks, in this way, it is implemented that limiting claws of the direction-limiting blocks are unidirectionally clamped in the internal helical gear teeth to limit the gear disk to unidirectionally rotate; one end of the friction motion energy storage mechanism is connected to the gear disk, and the overload protection mechanism is connected to the mounting disk.

[0010] In order to reduce the number of parts as much as possible, the overload protection mechanism includes a circular ring whose arc surface is convexly provided with convex teeth, and an internal gear ring engaged with the convex teeth, the internal gear ring is disposed on the top surface of the mounting disk, a middle of the circular ring is provided with a long convex key, the side cover is correspondingly provided with a long key-groove matched up and connected with the long convex key, in case of overloaded energy storage for the friction motion energy storage mechanism, the circular ring is stressed and deformed so that the convex teeth are disengaged with the internal gear ring, thereby implementing that the direction-limiting mechanism and the friction motion energy storage mechanism rotate with the disk bodies, and the friction motion energy storage mechanism stops energy storage.

[0011] The energy storage mechanism of the present invention includes an energy storage spring and a spring case, the energy storage spring is placed in the spring case, an outside end of the energy storage spring is clamped and connected with the spring case, an inside end of the energy storage spring is clamped and connected with the direction-limiting mechanism, an energy storage rotation direction of the energy storage spring is the same as a rotational direction limited by the direction-limiting mechanism, and the spring case is fixedly connected to the disk bodies.

[0012] Further, a through hole is formed in the middle of the spring case, at the lower part of the gear disk there is provided with a lug that passes through the through hole and enters into the spring case, along a periphery of the lug there is provided with a plurality of arc-shaped pieces distributed at interval, with a gap kept between the arc-shaped piece and the lug, at the lower end of the arc-shaped piece there is provided with a hook; after the lug of the gear disk is inserted into the through hole of the spring case, the hook stretches out of the through hole to fasten to a side the through hole, in this way it is realized that the gear disk is connected to the spring case,

and an inside end of the energy storage spring is clamped and connected to the arc-shaped piece of the gear disk.

[0013] In order to improve a smooth performance of rotation of the disk bodies, the middle of the gear disk is provided with a bearing pedestal on which a bearing is mounted, and the connecting shaft is inserted and connected to the bearing hole.

[0014] In order to prevent the disk bodies from damaging due to frequent friction and to avoid it is difficult to store energy by means of friction due to small friction coefficient of the disk bodies, a disk mouth edge of the disk bodies is connected with a friction ring which is locked and connected to the disk bodies by means of screws, the diameter of the friction ring is greater than the disk mouth diameter of the disk bodies, the side cover is covered on the outer side surface of the friction ring, and the side cover is connected to the connecting shaft by means of bolts.

[0015] In the present invention, either of the disk bodies of the rotating bodies is internally provided with a friction motion energy storage mechanism, one end of which is connected to the disk bodies and the other end is connected to the side cover, by pinching the side cover of the two rotating bodies, the disk bodies are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism by means of friction rolling. After the energy storage, the disk bodies are out of contact with the external contact surface, and the friction motion energy storage mechanism releases the energy to drive the two disk bodies to synchronously rotate towards the direction opposite to the rolling direction, at the moment, the side cover is released to realize rotation of the whole yo-yo ball body. In this way, the yo-yo ball body can rotate without throwing the yo-yo ball body by a rope. Even if the rope is too short, the ball body can rotate at high speed after being thrown out, which is not affected by an acceleration region after the ball body is thrown out. Therefore, even though a shorter player may enjoy playing with the yo-yo ball to the fullest, and complete various fancy moves. Requirements of players at different ages and different heights can be met. Compared with an existing yo-yo ball, the yo-yo ball with friction motion energy storage and acceleration functions increases a new operation mode and a new playing method, is more interesting, and more diversified in playing methods. In addition, either of the disk bodies is internally provided with a direction-limiting mechanism and an overload protection mechanism, thus unnecessary loss of energy released by the friction motion energy storage mechanism is reduced, duration of rotation of the yo-yo ball is effectively improved, the friction motion energy storage mechanism can be prevented from damaging due to overloaded energy storage, and the service life of the yo-yo ball can be effectively prolonged. The disk mouth of the disk bodies is connected with a friction ring whose diameter is greater than the disk mouth diameter of the disk bodies. Therefore, during energy storage by means of friction, the con-

tact friction occurs between the friction ring and the contact surface, the disk bodies can be better protected from friction and damaging to further prolong the service life of the yo-yo ball, and the friction coefficient of the friction ring is large, thus it does not slip during rolling friction, the energy storage effect is improved, and it is only needed to replace the friction ring if the energy storage effect is decreased. The yo-yo ball is slickly designed, not only meeting the requirements of shorter users for entertainment, but also increasing methods for playing with the yo-yo ball, being very interesting, meeting children's entertainment needs and psychology of seeking for what is novel, leaving room for players to give full scope to creativity in playing methods,, and making the yo-yo ball be attractive to them for longer time.

[0016] The following further describes the present invention with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0017]

FIG. 1 is a tridimensional schematic structural diagram of the present invention;

FIG. 2 is a schematic structural sectional view of the present invention;

FIG. 3 is a schematic diagram of a breakdown structure of the present invention; and

FIG. 4 is a schematic structural diagram of breakdown of the side cover, the overload protection mechanism and the direction-limiting mechanism of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0018] As shown in FIGs. 1-4, a yo-yo ball with friction motion energy storage and acceleration functions, including two rotating bodies 1 and a connecting shaft 2 connecting the two rotating bodies 1, either of the rotating bodies 1 includes a disk body 11 and a side cover 12, the disk body 11 can rotate relatively to the side cover 12, and either of the disk bodies 11 is internally provided with a friction motion energy storage mechanism 3, one end of the friction motion energy storage mechanism 3 is connected to the disk body 11 and the other end is connected to the side cover 12, by pinching the side cover 12 of the two rotating bodies 1, the disk bodies 11 are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism 3 by means of friction rolling. After the energy storage, the disk bodies 11 are out of contact with the external contact surface, and the friction motion energy storage mechanism 3 releases the energy to drive the two disk bodies 11 to synchronously rotate towards the direction opposite to the rolling direction, at the moment, the side cover 12 is released to realize rotation of the whole yo-yo ball body. Thus, the yo-yo ball body can rotate without throwing the yo-yo ball body by a rope. Even if the rope

is too short, the ball body can rotate at high speed after being thrown down, which is not affected by an acceleration region after the ball body is thrown down. Therefore, even though a shorter player may enjoy playing with the yo-yo ball to the fullest, and complete various fancy moves. Requirements of players at different ages and different heights can be met. Compared with an existing yo-yo ball, the yo-yo ball with friction motion energy storage and acceleration functions increases a new operation mode and a new playing method, is more interesting, and more diversified in playing methods.

[0019] As shown in FIG. 3, in this embodiment, either of the disk bodies 11 is internally provided with a direction-limiting mechanism 4 and an overload protection mechanism 5 which are disposed in a position where the side cover 12 is connected to the friction motion energy storage mechanism 3. The direction-limiting mechanism 4 in this embodiment includes four direction-limiting blocks 41, a mounting disk 42 in which all the direction-limiting blocks 41 are mounted, and a gear disk 43 which is concavely provided with internal helical gear teeth 431, where the bottom surface of the mounting disk 42 is provided with four pin holes 421, the direction-limiting blocks 41 are inserted into the pin holes 421 by means of pin bolts 9. In this way, it is implemented that the direction-limiting blocks 41 are automatically rotatably connected to the bottom surface of the mounting disk 42 and protrude above the mounting disk 42. The gear disk 43 is covered on the direction-limiting blocks 41, in this way, it is implemented that limiting claws of the direction-limiting blocks 41 are clamped in the internal helical gear teeth 431, thus when the gear disk 43 rotates against the direction of the direction-limiting blocks 41, the limiting claws are clamped in the internal helical gear teeth 431 so that the gear disk 43 is unable to rotate, thereby realizing a unidirectional rotation of the gear disk 43. The gear disk 43 of the direction-limiting mechanism 4 is connected to one end of the friction motion energy storage mechanism 3. The overload protection mechanism 5 of this embodiment includes a circular ring 51 whose arc surface is convexly provided with convex teeth 511, and an internal gear ring 52 engaged with the convex teeth 511, where the internal gear ring 52 is disposed on the top surface of the mounting disk 42, i.e., the mounting disk 42 and the internal gear ring 52 adopt a unibody design, thus the number of parts may be reduced, the cost may be reduced, and the structure may be more compact. A middle of the circular ring 51 is provided with a long convex key 512, the side cover 12 is correspondingly provided with a long key-groove 121 matched up and connected with the long convex key 512, in total three convex teeth 511 of the circular ring 51 are provided. In case of overloaded energy storage for the friction motion energy storage mechanism 3, namely, when friction rolling is basically impossible, if the user continues making it forcibly, the circular ring 51 may be stressed and deformed so that the convex teeth 511 are disengaged with the internal gear ring 52, so the side cover 12 is unable

to limit the mounting disk 42, and the whole direction-limiting mechanism 3 is in a disengaged state, thus it can rotate with the disk bodies 11, thereby making the friction motion energy storage mechanism 3 stop energy storage.

[0020] As shown in FIG. 2 and FIG. 3, the energy storage mechanism 3 of this embodiment includes an energy storage spring 31 and a spring case 32, where the energy storage spring 31 is a helical spring, which is placed in the spring case 32, and the outside end thereof is fixed to the spring case 32. The spring case 32 includes a case body 322 and a cover body 321, where a notch 323 is formed at the edge of the case body 322, an outside end of the energy storage spring 31 is fixedly connected to the notch 323, along the periphery of the cover body 321 there is provided with three lugs 324 with holes; after the cover body 321 is covered on the case body 322, they are aligned by means of holes on the lugs 324 and screw holes on the disk bodies 11, and are connected and fixed by means of screws. A through hole 320 is formed in the middle of the spring case 32. The lower part of the gear disk 43 of the direction-limiting mechanism 4 is correspondingly provided with a lug 430 that passes through the through hole 320 and enters into the spring case 32, along a periphery of the lug 430 there is provided with three arc-shaped pieces 432 distributed at interval, with a gap kept between the arc-shaped piece 432 and the lug 430, and at a lower end of each of the arc-shaped pieces 432 there is provided with a hook 433. After the lug 430 of the gear disk 43 is inserted into the through hole 320 of the spring case 32, the hook 433 stretches out of the through hole 320 to fasten to a side the through hole, in this way it is realized that the gear disk 43 is connected to the spring case 32. An inside end of the energy storage spring 31 is clamped and connected to the arc-shaped pieces 432 of the gear disk 43; the middle of the gear disk 43 is provided with a bearing pedestal 434 on which a bearing 6 is mounted, and the connecting shaft 2 is inserted and connected to the middle hole of the bearing 6. The disk mouth edge of the disk bodies 11 in this embodiment is connected with a friction ring 7, the friction coefficient of the friction ring 7 is greater than that of the disk bodies 11, the friction ring 7 is provided with a countersink, screws passing through the countersink are screwed into the screw holes at the disk mouth edge of the disk bodies 11, thereby implementing a locked connection. The diameter of the friction ring 7 is greater than a disk mouth diameter of the disk bodies 11, thus during energy storage by means of friction, the contact friction occurs between the friction ring 7 and the contact surface, the disk bodies 11 can be better protected from friction and damaging to further prolong the service life of the yo-yo ball, and the friction coefficient of the friction ring 7 is large, thus it does not slip during rolling friction, the energy storage effect is improved, and it is only needed to replace the friction ring 7 if the energy storage effect is decreased. In addition, near the edge of the outer side surface of the friction ring 7 there is

sleeved with a decorative ring edge 8 which is downward provided with arc-shaped convex ribs 81, and the friction ring 7 is correspondingly provided with arc-shaped slot holes 71 into which the arc-shaped convex ribs 81 are inserted, in this way, it is implemented that the decorative ring edge 8 is fixed to the friction ring 7.

[0021] As shown in FIG. 4, the side cover 12 of this embodiment is covered on the outer side surface of the friction ring 7, a countersink 122 is formed in the middle of the side cover 12, in the middle of a long convex key 512 of a circular ring 51 there is provided with a circular hole 513, and the bottom of the long convex key 512 is concavely provided with a long key-groove 514 which is smaller than the long convex key 512. In this embodiment, the middle of the mounting disk 42 and the middle of the lug 430 of the gear disk 43 are respectively provided with a through hole through which the connecting shaft 2 passes. In this embodiment, an end of the connecting shaft 2 is designed to be a long convex key 21 matching up with the long key-groove 514 on the bottom of the circular ring 51, and the middle of the long convex key 21 is provided with a screw hole 22. After the connecting shaft 2 passes through the through holes of the mounting disk 42 and of the gear disk 43, the long convex key 21 at the end thereof is inserted into the long key-groove 514 of the circular ring 51, a bolt passing, from the outer side of the side cover 12, through the countersink 122 of the side cover 12 and the circular hole 513 of the circular ring 51 is screwed into the screw hole 22 of the connecting shaft 2, as shown in FIG. 3. In addition, a main bearing is disposed between two rotating bodies 1 of the yo-yo ball in this embodiment, and the rope of the yo-yo ball is wrapped around the main bearing.

[0022] A playing method of the yo-yo ball is as below:

The yo-yo ball is wrapped around by the rope, pinching the side cover 12 at two sides of the yo-yo ball body, then placing the yo-yo ball on a desk or the ground or other external contact surfaces, bringing the friction ring 7 into contact with the contact surface, and rolling it towards one direction. If it is easy to roll forward without too much resistance, this means that the rolling direction is not the direction of energy storage for the friction motion energy storage mechanism 3. No rolling resistance is because the gear disk 43 of the direction-limiting mechanism 4 is not limited by the direction-limiting blocks 41, i.e., the gear disk 43 can rotate relatively to the side cover 12, in other words, the gear disk 43, the energy storage spring 31 and the spring case 32 can synchronously rotate as the disk bodies 11 roll, thus it is unable to store energy in the energy storage spring 31. Hence it can be judged that it is proper to roll in the opposite direction, i.e., to roll backward, in this case, the gear disk 43 is limited by the direction-limiting blocks 41 and thus is unable to rotate. Hence, the inside end of the energy storage spring 31 is stationary, while the outside end thereof rotates as

the disk bodies 11 roll, thereupon the energy storage spring 31 starts to store energy. It indicates that energy storage for the energy storage spring 31 is full when it is unable to further roll backward. In this case, if it is continued to roll backward forcibly, the circular ring 51 is subjected to too large torsional force and thus is deformed, so that convex teeth 511 are disengaged from the internal gear ring 52 of the mounting disk 42. Thus, the mounting disk 42 and the gear disk 43 rotate as the disk bodies roll, thereby effectively protecting the energy storage spring 31 from damaging due to excessive energy storage. After energy storage is full, with a finger of the other hand entwined by the rope, taking the yo-yo ball away from the contact surface, so the friction resistance of the friction ring 7 is relieved, the energy storage spring 31 starts to restore toward the opposite direction to release energy, thereby driving the disk bodies 11 to rotate in the opposite direction. Similarly, when the gear disk 43 rotates in the opposite direction, it is not limited by the direction-limiting blocks 41, hence the gear disk 43 and the disk bodies 11 rotate synchronously; now releasing the yo-yo ball, the yo-yo ball falls off along the rope, and finally rotates at high speed at the end of the rope, and further various fancy moves are conducted.

[0023] Although the present invention is described by reference to embodiments, the description does not signify to limit the present invention. By reference to the description of the present invention, other variations of the embodiments disclosed are expectable for those skilled in the art, and these variations shall fall within the scope limited by the claims.

Claims

1. A yo-yo ball with friction motion energy storage and acceleration functions, comprising two rotating bodies (1) and a connecting shaft (2) connecting the two rotating bodies (1), **characterized in that** either of the rotating bodies (1) comprises a disk body (11) and a side cover (12), the disk body (11) can rotate relatively to the side cover (12), either of the disk bodies (11) is internally provided with a friction motion energy storage mechanism (3), one end of the friction motion energy storage mechanism (3) is connected to the disk body (11) and the other end is connected to the side cover (12), by pinching the side cover (12) of the two rotating bodies (1), the disk bodies (11) are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism (3) by means of friction rolling; after the energy storage, the disk bodies (11) are out of contact with the external contact surface, and the friction motion energy storage mechanism (3) releases the energy to drive the two disk

bodies (11) to synchronously rotate towards a direction opposite to a rolling direction.

2. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 1, **characterized in that:** either of the disk bodies (11) is internally provided with a direction-limiting mechanism (4) disposed in a position where the side cover (12) is connected to the friction motion energy storage mechanism (3), one end of the direction-limiting mechanism (4) is connected to the side cover (12), the other end is connected to the friction motion energy storage mechanism (3), a rotational direction limited by the direction-limiting mechanism (4) is the same as an energy storage direction of the friction motion energy storage mechanism (3), by pinching the side cover (12) of the two rotating bodies (1), the disk bodies (11) are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism (3) by means of friction rolling towards the rotational direction limited by the direction-limiting mechanism (4).
3. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 1, **characterized in that:** either of the disk bodies (11) is internally provided with an overload protection mechanism (5) disposed in a position where the side cover (12) is connected to the friction motion energy storage mechanism (3), one end of the overload protection mechanism (5) is connected to the side cover (12), the other end is connected to the friction motion energy storage mechanism (3); in case of overloaded energy storage for the friction motion energy storage mechanism (3) by pinching the side cover (12), under the action of the overload protection mechanism, the side cover (12) is disconnected from the friction motion energy storage mechanism (3), thereby realizing to stop energy storage for the friction motion energy storage mechanism (3).
4. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 1, **characterized in that:** either of the disk bodies (11) is internally provided with a direction-limiting mechanism (4) and an overload protection mechanism (5) which are disposed in a position where the side cover (12) is connected to the friction motion energy storage mechanism (3), one end of the direction-limiting mechanism (4) is connected to the friction motion energy storage mechanism (3), the other end is connected to one end of the overload protection mechanism (5), the other end of the overload protection mechanism (5) is connected to the side cover (12), a rotational direction limited by the direction-limiting mechanism (4) is the same as an energy storage direction of the friction motion energy storage mechanism (3), by pinching the side cover (12) of the two

rotating bodies (1), the disk bodies (11) are in contact with an external contact surface to realize energy storage for the friction motion energy storage mechanism (3) by means of friction rolling towards the rotational direction limited by the direction-limiting mechanism (4); in case of overloaded energy storage for the friction motion energy storage mechanism (3), under the action of the overload protection mechanism (5), the side cover (12) is disconnected from the direction-limiting mechanism (4), thereby realizing to stop energy storage for the friction motion energy storage mechanism (3).

5. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 4, **characterized in that:** the direction-limiting mechanism (4) comprises a plurality of direction-limiting blocks (41), a mounting disk (42) in which all the direction-limiting blocks (41) are mounted, and a gear disk (43) which is concavely provided with internal helical gear teeth (431), the direction-limiting blocks (41) can be automatically rotatably connected, by means of pin bolts (40), to a bottom surface of the mounting disk (42) and protrude above the mounting disk (42); the gear disk (43) is covered on the direction-limiting blocks (41), in this way, it is implemented that limiting claws of the direction-limiting blocks (41) are unidirectionally clamped in the internal helical gear teeth (431) to limit the gear disk (43) to unidirectionally rotate; one end of the friction motion energy storage mechanism (3) is connected to the gear disk (43), and the overload protection mechanism (5) is connected to the mounting disk (42).
6. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 5, **characterized in that:** the overload protection mechanism (5) comprises a circular ring (51) whose arc surface is convexly provided with convex teeth (511), and an internal gear ring (52) engaged with the convex teeth (511), the internal gear ring (52) is disposed on the top surface of the mounting disk (42), a middle of the circular ring (51) is provided with a long convex key (512), the side cover (12) is correspondingly provided with a long key-groove (121) matched up and connected with the long convex key (512), in case of overloaded energy storage for the friction motion energy storage mechanism (3), the circular ring (51) is stressed and deformed so that the convex teeth (511) are disengaged with the internal gear ring (52), thereby implementing that the direction-limiting mechanism (4) and the friction motion energy storage mechanism (3) rotate with the disk bodies (11), and the friction motion energy storage mechanism (3) stops energy storage.
7. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 2, 4,

5 or 6, **characterized in that:** the friction motion energy storage mechanism (3) comprises an energy storage spring (31) and a spring case (32), the energy storage spring (31) is placed in the spring case (32), an outside end of the energy storage spring (31) is clamped and connected with the spring case (32), an inside end of the energy storage spring (31) is clamped and connected with the direction-limiting mechanism (4), an energy storage rotation direction of the energy storage spring (31) is the same as a rotational direction limited by the direction-limiting mechanism (4), and the spring case (32) is fixedly connected to the disk bodies (11).

8. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 7, **characterized in that:** a through hole (320) is formed in the middle of the spring case (32), at a lower part of the gear disk (43) there is correspondingly provided with a lug (430) that passes through the through hole (320) and enters into the spring case (32), along a periphery of the lug (430) there is provided with a plurality of arc-shaped pieces (432) distributed at interval, with a gap kept between the arc-shaped piece (432) and the lug (430), at a lower end of the arc-shaped piece (432) there is provided with a hook (433); after the lug (430) of the gear disk is inserted into the through hole (320) of the spring case (32), the hook (433) stretches out of the through hole (320) to fasten to a side the through hole, in this way it is realized that the gear disk (43) is connected to the spring case (32), and the inside end of the energy storage spring (31) is clamped and connected to the arc-shaped pieces (432) of the gear disk (43).
9. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 8, **characterized in that:** a middle of the gear disk (43) is provided with a bearing pedestal (434) on which a bearing (6) is mounted, and the connecting shaft (2) is inserted and connected to a middle hole of the bearing (6).
10. The yo-yo ball with friction motion energy storage and acceleration functions according to claim 1, **characterized in that:** a disk mouth edge of the disk bodies (11) is connected with a friction ring (7) which is locked and connected to the disk bodies (11) by means of screws, a diameter of the friction ring (7) is greater than a disk mouth diameter of the disk bodies (11), the side cover (12) is covered on an outer side surface of the friction ring (7), and the side cover (12) is connected to the connecting shaft (2) by means of bolts.

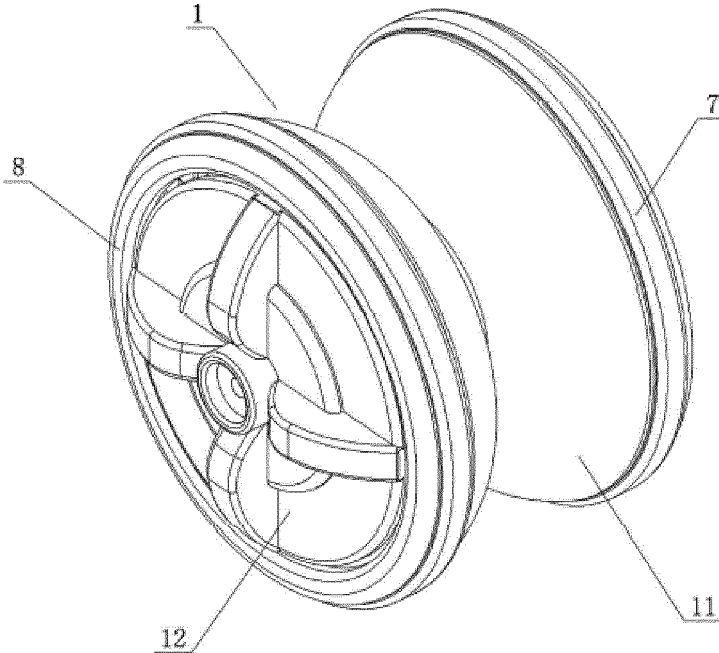


FIG. 1

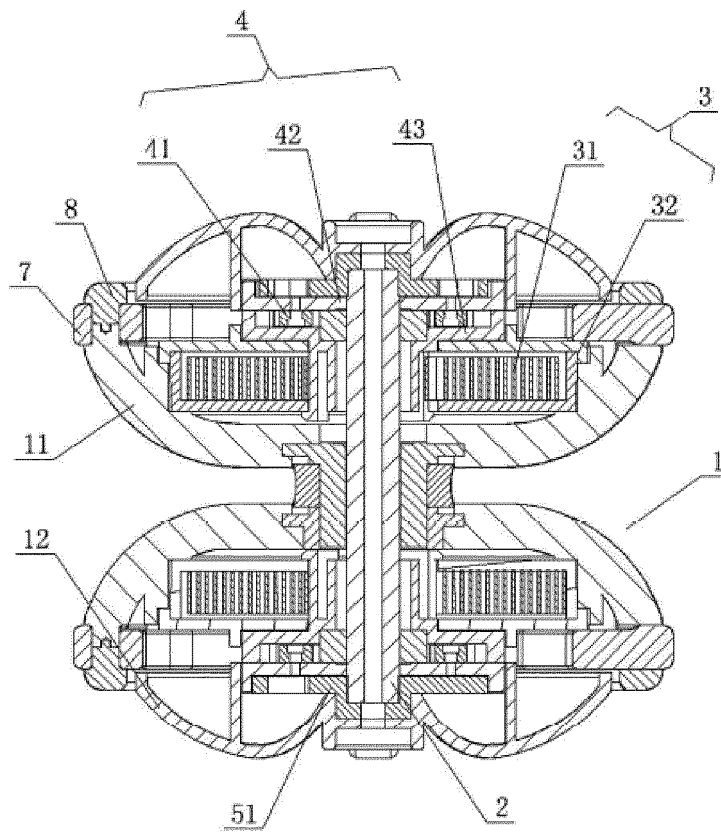


FIG. 2

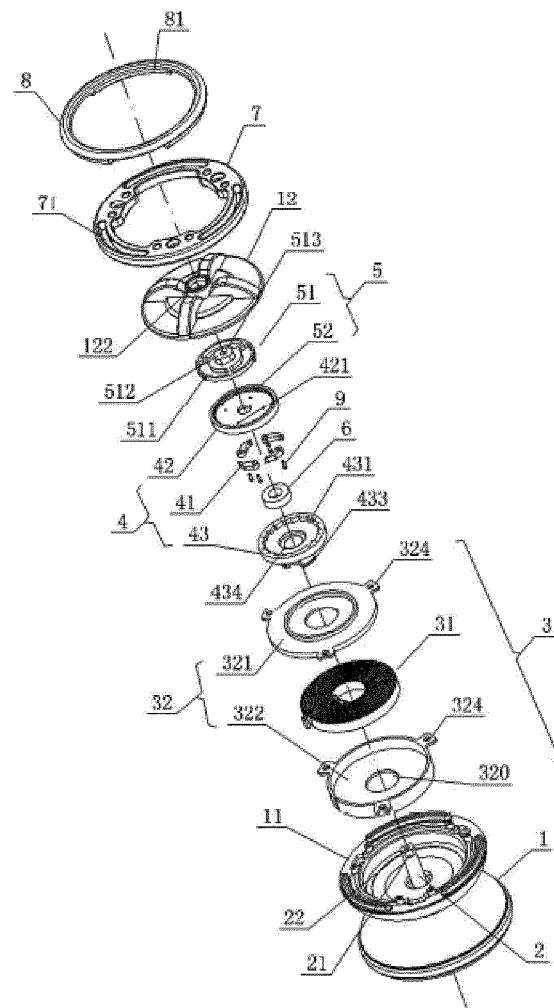


FIG. 3

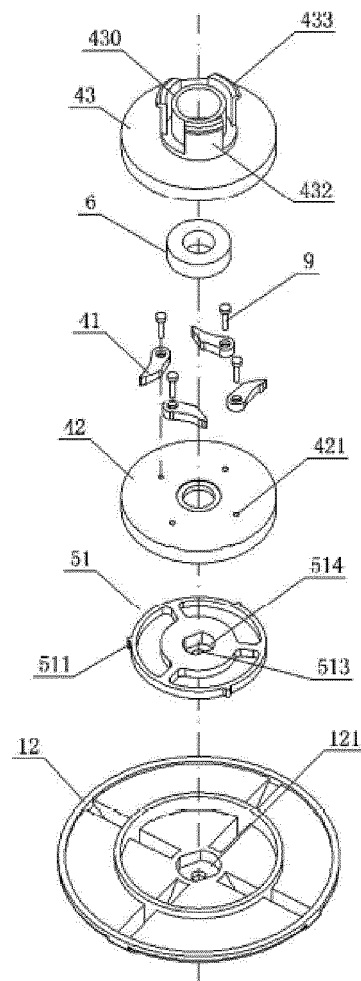


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/070951

A. CLASSIFICATION OF SUBJECT MATTER

A63H 1/30 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A63H 1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI, SIPOABS, CNTXT, CNABS, CNKI: AOFEI, yoyo, climb+, top, friction, roll+, driv+, ring, block, energy, sav+,
accumulat+, clockwork, spring

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 204293856 U (GUANGDONG AOFEI ARTISTIC CULTURE CO., LTD. et al.) 29 April 2015 (29.04.2015) claims 1-10, description, paragraphs [0021]-[0026] and figures 1-4	1-10
A	CN 2427254 Y (AODI TOY INDUSTRY CO., LTD. GUANGDONG) 25 April 2001 (25.04.2001) description, pages 3 and 4 and figures 1-3	1-10
A	CN 103405918 A (GUANGDONG AOFEI ARTISTIC CULTURE CO., LTD. et al.) 27 November 2013 (27.11.2013) the whole document	1-10
A	CN 2880189 Y (CHEN, Kaihuang) 21 March 2007 (21.03.2007) the whole document	1-10

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search 10 July 2015	Date of mailing of the international search report 23 July 2015
Name and mailing address of the ISA/CN State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer ZHANG, Lihong Telephone No. (86-10) 62085509

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/070951

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4327518 A (KNAUFF ROBERT J) 04 May 1982 (04.05.1982) the whole document	1-10
A	JPH 11300054 A (SENMORI SANGYO KK) 02 November 1999 (02.11.1999) the whole document	1-10

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/070951

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 204293856 U	29 April 2015	None	
CN 2427254 Y	25 April 2001	None	
CN 103405918 A	27 November 2013	AU 2013385791 A1	12 February 2015
		WO 2015014049 A1	05 February 2015
		KR 20150030638 A	20 March 2015
		CA 2878517 A1	29 January 2015
CN 2880189 Y	21 March 2007	None	
US 4327518 A	04 May 1982	None	
JPH 11300054 A	02 November 1999	JP 2889229 B1	10 May 1999