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(54) SPRING POWER UNIT FOR TOYS

(71) We, TOMY KOGYO CO., LTD., a joint-stock company organised and existing under the laws of Japan, of No. 10, 9, 7-chome, Tateishi, Katsushika-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates generally to a spring power unit and more particularly to a spring power unit adapted as a drive means to be incorporated in a toy as a unit for operating it. Still more particularly, the present invention relates to a spring power unit which can be used as a drive means for operating a toy by incorporating it into the toy and which is suited for mechanical toys other than powered toy vehicles, such as a walking toy, a toy fish, etc.

According to the present invention a spring power unit for use as a drive means for operating a toy with at least one operative member by incorporating it into the toy, comprises a housing having side walls, a spiral spring secured at one end to a winding shaft journalled in the side walls and a gear train comprising a driving gear wheel mounted on the winding shaft and driven gear wheels mounted on driven shafts journalled in the side walls, characterised in that said housing is divided into two chambers by a partition wall provided between the side walls of said housing and through which said winding shaft and said driven shafts extend, that said spiral spring is disposed within one of the two chambers, whilst said gear train is disposed within the other of the two chambers, that said housing, said partition wall, said driving gear wheel, said driven gear wheels and said driven shafts are made of plastics material and that at least one of said driven shafts projects outwardly of at least one of said side walls and is provided, at at least one projecting end thereof, with a crank or cam which is adapted to be operatively engaged with said one operative member of said toy so as to impart a swinging or oscillatory motion to said one operative member.

When the toy in which the spring power unit is to be incorporated is a walking toy, a braking device may, preferably, be provided in the housing for retarding rotational speed of the gear train so that the walking toy can walk slowly on a supporting surface.

Also the said driven gear wheels may be formed integrally with the driven shafts on which they are mounted, so that the cost of producing the power unit can be reduced and at the same time, the dimensions of the power unit as a whole can be minimized, thereby making it possible to manufacture very small toys of the kinds stated above. In fact, according to the present invention, it is possible to manufacture such a small toy as can be easily gripped by the hand of a child.

It is, therefore, one object of the present invention to provide a spring power unit which may be adapted for use as a drive means for various kinds of mechanical toys other than powered toy vehicles by incorporating it into such toys.

Another object of the invention is to provide a miniature spring power unit of the type described above which can be produced at a relatively small expense and which is especially suited for such mechanical toys of a miniature size.

The preferred embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a vertical cross-sectional front view of the embodiment from which a crank or cam has been removed;

Figure 2 is a side view showing the internal mechanism of the embodiment;

Figure 3 is a front view of the embodiment to which a crank is attached;

Figure 4 is a front view of a variant of the embodiment to which two cams are attached;

Figure 5 is an exloded view of the embodiment shown in Figure 1;

Figure 6 is a front view of a toy in the form of a bird, illustrating the state in which a variant of the embodiment shown in Figure 3 is incorporated in a body of the toy;

Figure 7 is a right side view of the toy shown in Figure 6;

Figure 8 is a left side view of the toy shown in Figure 6 from which a body section has been removed;

Figure 9 is a front view of a toy in the form of a dog, showing the state in which a variant of the embodiment shown in Figure 4 is incorporated in a body of the toy;

Figure 10 is a right side view of the toy shown in Figure 9;

Figure 11 is a left side view of the toy shown in Figure 9 from which a body section has been removed; and

Figure 12 is a plan view of a toy in the form of a fish with its body partly broken away, showing the state in which the embodiment shown in Figure 3 is incorporated in the body.

Referring now to the drawings in Figures 1 to 5, the spring power unit is denoted generally by the character P and comprises a housing 1 composed of a pair of housing sections 1A, 1B each having a side wall 1a, 1b and secured to each other. Provided between the side walls 1a, 1b is a partition wall 1c which divides the internal space of housing 1 into left and right chambers *a* and *b*. A conventional spring motor 2 in the form of a spiral spring is mounted in the right chamber *b*.

Preferably, the housing sections 1A, 1B and the partition wall 1c are moulded from plastics material, respectively. The side walls 1a, 1b and the partition wall 1c are each provided therein with first, second and third bearing apertures 4, 5, 6, The first apertures 4, 4, 4, the second apertures 5, 5, 5 and the third apertures 6, 6, 6 are aligned with one another, respectively and rotatably support first, second and third shafts 4b, 5b, 6b, respectively. The first shaft 4b is provided with a double gear wheel composed of a gear wheel 4a and a pinion 4a' and integrally formed with the shaft 4b from plastics material. The second shaft 5b is provided with a pinion 5a and a ratchet 5a' which are integrally formed therewith from plastics material. The third shaft 6b is provided with a double gear wheel composed of a gear wheel 6a and a pinion 6a' and integrally formed with the shaft 6b.

Apertures 7, 7, 7 which are in alignment with one another are also formed respectively in the side walls 1a, 1b and partition wall 1c and rotatably receive a winding shaft 7a around which the spring 2 is encircled and which extends outwardly of the side wall 1B. The spring 2 is secured at its inner end to the shaft 7a and at its outer end to a forked projection 8 provided on the partition wall 1c.

A gear wheel 9 which also serves as a clutch disk is rotatably mounted on the spring-winding shaft 7a. A pawl member 10 is fixedly mounted on this shaft 7a and has a pair of spring tensioned pawl arms terminating in fingers 10a, 10a adapted to engage in catch apertures 9a,9a formed in gear wheel 9 so that gear wheel 9 can be rotated by and with the pawl member 10 in counterclockwise direction as viewed in Figure 2 as the shaft 7a is rotated by the spring 2. This one-way clutch composed of gear 9 and pawl member 10 is located within the left chamber *a*. Teeth 9b of the gear wheel 9 are meshed with the pinion 4a' of first shaft 4b, the gear wheel 4a coaxial with the pinion 4a' is engaged with the pinion 6a' of third shaft 6b and the gear wheel 6a coaxial with this pinion 6a' is in meshed engagement with the pinion 5a of second shaft 5b, thus forming a gear train within the left chamber *a*.

A shaft 11 is rotatably supported by bearing apertures 12, 12, 12 respectively formed in side walls 1a, 1b and partition wall 1c and carries a ratchet pawl member 11a having fork ends 11b, 11b which are adapted to be alternately engaged with the ratchet wheel 5a' so that when the spring motor 2 is operated, rotational speed of said gear train may be retarded.

The housing 1 of the unit P can be assembled in such a way that a pair of pins 13, 13 projecting inwardly from lower corner portions of the left side wall 1a is passed through a pair of apertures 13a, 13 formed in the partition wall 1c, then is fitted in a pair of cylinders 13b, 13b projecting inwardly from lower corner portions of the right side wall 1b and then resilient lugs 14, 14, 14 projecting inwardly from appropriate portions of the left side housing section 1A are resiliently engaged at their engaging portions with recesses 14a, 14a, 14a formed in the right side housing section 1B. Thus, the housing 1 can be assembled without the use of individual fastening members, such as screws or the like. Indicated by the numeral 15 is a lug which restricts the expansion of the spiral spring 2 to a certain extent, and the numeral 16 indicates a knob which is secured to one end of the winding shaft 7a.

In the embodiment shown in Figure 3, the second shaft 5b projects outwardly through the bearing aperture 5 of the left side wall 1a of housing 1 and has at its projecting end a crank 17 or eccentric which is fixedly secured thereto. In a variant shown in Figure 4, the first shaft 4b projects outwardly through the bearing apertures 4, 4 of the side walls 1a, 1b of housing 1 and is provided, at its both ends, with eccentric cams 18, 18which are fixedly mounted thereon, respectively.

Figures 6 to 8 show a toy in the form of a

bird in which a variant of the embodiment of Figure 3 is incorporated. This toy comprises a body 19 and an operative member 20 which comprises two leg-simulating portions 20a, 20b having foot-simulating portions 20a', 20b' which are integrally connected with each other by a connection 20c. The body 19 is composed of a pair of symmetrical hollow body sections 19a, 19b secured together. The power unit P is mounted in the body 19. The winding shaft 7a projects outwardly through an aperture formed in the body section 19a so that the spring 2 may be wound up from the outside of the body. The operative member 20 is swingably connected with the body 19. More specifically, the operative member 20 is pivoted, at its leg-simulating portions 20a, 20b, to the power unit P mounted in the body 19, by means of a pivot pin 20', and is normally biased rearwardly by means of a tension spring 22. One 20a of the two leg-simulating portions 20a, 20b has a forked extension 21 which is provided with parallel inner edges 21a, 21b with which the crank 17 or eccentric is adapted to be engaged.

When it is desired to operate this toy, firstly, the spring motor 2 is wound to store energy by manipulation of the knob 16 of winding shaft 7a. Then as the toy is placed on a supporting surface and released, upon completion of the winding, the spring motor 2 operates by virtue of the stored energy therein and transmits a swinging motion to the operative member 20 through the medium of said gear train and crank means 17. In this case, when the swingable member 20 is forwardly swung against the action of the tension spring 22 by the engagement of the crank means 17 with the rear edge 21a of the forked extension 21, the tension spring 22 is energized. Accordingly, as the crank means 17 is disengaged from said edge 21a, the tension spring 22 acts to cause the foot-simulating portions 20a', 20b' to strike against the surface. Thus, as the spring power unit P is operated, said portions 20a', 20b' are adapted to strike repeatedly against the surface, causing the toy to travel thereon by reaping bounds.

Figure 9 to 11 show a walking toy in the form of a dog in which the embodiment shown in Figure 4 is incorporated. This toy comprises a body 23 composed of a pair of symmetrical hollow body sections 23a, 23b and a pair of leg members 24A, 24B each having a leg-simulating portion 24A', 24B' and a foot-simulating portion 24A", 24B" and being swingably connected with the body 23. The eccentric cams 18, 18 of the power unit P mounted in the body 23 are rotatably fitted in openings 25, 25 respectively formed in the leg-simulating portions 24A', 24B' so that when the cams 18, 18 are rotated, the leg 24A, 24B are alternately swung about the axis of a shaft 26 having guide members 27, 27 which are slidably fitted in slots 28, 28 formed in leg-simulating portions 24A', 24B' at their upper portions. Thus, when the cams 18, 18 are rotated by the power of the spring motor 2, the legs 24A, 24B are caused to step forward alternately, thereby causing the walking toy to walk on a supporting surface.

Figure 12 shows a toy fish in which the embodiment shown in Figure 3 is incorporated. This toy fish comprises a body 29 shaped externally so as to simulate a fish and a separate tail member 30 pivoted to the body 29 at 31 so as to be operated by the power unit P for an oscillatory motion. The body 29 comprises a lower hollow body section 29A and an upper hollow body section 29B which are moulded from plastics material and secured together. The separate tail member 30 is also shaped externally so as to simulate a tail of a fish and comprises a fin part 30A and a transmission arm 30B which is intergrally formed therewith from plastics material. The transmission arm 30B is formed with a longitudinally extending slot 32 in which the eccentric pin 17 of the power unit P is engaged from below.

In operation, when the spring motor 2 of the power unit P is operated, the eccentric pin 17 is rotated and causes the tail member 30 to be oscillated, about pivot pin 31, relative to the body 29, whereby the toy fish makes a swimming motion when placed on water, continueing swimming thereon until the energy stored in the spring motor is dissipated.

It is to be noted that the provision of the braking device 5a', 11a is desirable for walking toys such as shown in Figures 9 to 11 in order to make them walk steadily, however, in case where toys are required to perform a quick motion as in the toys shown in Figures 6 to 8 and Figure 12, such braking device is not necessary and may be omitted.

It will be apparent that there are differences in rotational speed between the gear wheel shafts 4b, 5b, 6b, and either one of them may be selectively utilized as an output shaft for operating a toy as occasion demands.

WHAT WE CLAIM IS:

1. A spring power unit for use as a drive means for operating a toy with at least one operative member by incorporating it into the toy, comprising a housing having side walls, a spiral spring secured at one end to a winding shaft journalled in the side walls and a gear train comprising a driving gear wheel mounted on the winding shaft and driven gear wheels mounted on driven shafts journalled in the side walls, characterised in that said housing is divided into two chambers by a partition wall provided between the side walls of said housing and through which said winding shaft and said driven shafts extend,

bird in which a variant of the embodiment of Figure 3 is incorporated. This toy comprises a body 19 and an operative member 20 which comprises two leg-simulating portions 20a, 20b having foot-simulating portions 20a', 20b' which are integrally connected with each other by a connection 20c. The body 19 is composed of a pair of symmetrical hollow body sections 19a, 19b secured together. The power unit P is mounted in the body 19. The winding shaft 7a projects outwardly through an aperture formed in the body section 19a so that the spring 2 may be wound up from the outside of the body. The operative member 20 is swingably connected with the body 19. More specifically, the operative member 20 is pivoted, at its leg-simulating portions 20a, 20b, to the power unit P mounted in the body 19, by means of a pivot pin 20', and is normally biased rearwardly by means of a tension spring 22. One 20a of the two leg-simulating portions 20a, 20b has a forked extension 21 which is provided with parallel inner edges 21a, 21b with which the crank 17 or eccentric is adapted to be engaged.

When it is desired to operate this toy, firstly, the spring motor 2 is wound to store energy by manipulation of the knob 16 of winding shaft 7a. Then as the toy is placed on a supporting surface and released, upon completion of the winding, the spring motor 2 operates by virtue of the stored energy therein and transmits a swinging motion to the operative member 20 through the medium of said gear train and crank means 17. In this case, when the swingable member 20 is forwardly swung against the action of the tension spring 22 by the engagement of the crank means 17 with the rear edge 21a of the forked extension 21, the tension spring 22 is energized. Accordingly, as the crank means 17 is disengaged from said edge 21a, the tension spring 22 acts to cause the foot-simulating portions 20a', 20b' to strike against the surface. Thus, as the spring power unit P is operated, said portions 20a', 20b' are adapted to strike repeatedly against the surface, causing the toy to travel thereon by reaping bounds.

Figure 9 to 11 show a walking toy in the form of a dog in which the embodiment shown in Figure 4 is incorporated. This toy comprises a body 23 composed of a pair of symmetrical hollow body sections 23a, 23b and a pair of leg members 24A, 24B each having a leg-simulating portion 24A', 24B' and a foot-simulating portion 24A", 24B" and being swingably connected with the body 23. The eccentric cams 18, 18 of the power unit P mounted in the body 23 are rotatably fitted in openings 25, 25 respectively formed in the leg-simulating portions 24A', 24B' so that when the cams 18, 18 are rotated, the leg 24A, 24B are alternately swung about the axis of a shaft 26 having guide members 27, 27 which are slidably fitted in slots 28, 28 formed in leg-simulating portions 24A', 24B' at their upper portions. Thus, when the cams 18, 18 are rotated by the power of the spring motor 2, the legs 24A, 24B are caused to step forward alternately, thereby causing the walking toy to walk on a supporting surface.

Figure 12 shows a toy fish in which the embodiment shown in Figure 3 is incorporated. This toy fish comprises a body 29 shaped externally so as to simulate a fish and a separate tail member 30 pivoted to the body 29 at 31 so as to be operated by the power unit P for an oscillatory motion. The body 29 comprises a lower hollow body section 29A and an upper hollow body section 29B which are moulded from plastics material and secured together. The separate tail member 30 is also shaped externally so as to simulate a tail of a fish and comprises a fin part 30A and a transmission arm 30B which is intergrally formed therewith from plastics material. The transmission arm 30B is formed with a longitudinally extending slot 32 in which the eccentric pin 17 of the power unit P is engaged from below.

In operation, when the spring motor 2 of the power unit P is operated, the eccentric pin 17 is rotated and causes the tail member 30 to be oscillated, about pivot pin 31, relative to the body 29, whereby the toy fish makes a swimming motion when placed on water, continueing swimming thereon until the energy stored in the spring motor is dissipated.

It is to be noted that the provision of the braking device 5a', 11a is desirable for walking toys such as shown in Figures 9 to 11 in order to make them walk steadily, however, in case where toys are required to perform a quick motion as in the toys shown in Figures 6 to 8 and Figure 12, such braking device is not necessary and may be omitted.

It will be apparent that there are differences in rotational speed between the gear wheel shafts 4b, 5b, 6b, and either one of them may be selectively utilized as an output shaft for operating a toy as occasion demands.

WHAT WE CLAIM IS:

1. A spring power unit for use as a drive means for operating a toy with at least one operative member by incorporating it into the toy, comprising a housing having side walls, a spiral spring secured at one end to a winding shaft journalled in the side walls and a gear train comprising a driving gear wheel mounted on the winding shaft and driven gear wheels mounted on driven shafts journalled in the side walls, characterised in that said housing is divided into two chambers by a partition wall provided between the side walls of said housing and through which said winding shaft and said driven shafts extend,

that said spiral spring is disposed within one of the two chambers, whilst said gear train is disposed within the other of the two chambers, that said housing, said partition wall, said driving gear wheel, said driven gear wheels and said driven shafts are made of plastics material and that at least one of said driven shafts projects outwardly of at least one of said side walls and is provided, at at least one projecting end thereof, with a crank or cam which is adapted to be operatively engaged with said one operative member of said toy so as to impart a swinging or oscillatory motion to said one operative member.

2. A spring power unit as set forth in claim 1, characterised in that said driven gear wheels are formed integrally with the driven shafts on which they are mounted.

3. A spring power unit as set forth in claim 1, characterised in that a braking device for retarding rotational speed of said gear train is provided in said housing.

4. A spring power unit as set forth in claim 1, wherein one of said driven gear wheel shafts projects outwardly of the side walls of said housing and is provided, at both projecting ends thereof, with cranks or cams which are adapted to be operatively engaged with operative members of said toy so as to impart swinging or oscillatory movements to said operative members.

5. A spring power unit as set forth in claim 1, wherein the other end of the spiral spring is secured to a projection provided on said partition wall.

6. A spring power unit as set forth in any of the preceding claims, wherein a one-way clutch is provided which comprises the driving gear wheel and a pawl member, the driving gear wheel being rotatably mounted on said winding shaft and formed therein with catch apertures so as to serve as a clutch disk, whilst the pawl member being fixedly mounted on said winding shaft and having a pair of pawl arms terminating in fingers which are adapted to engage in the catch apertures so that the driving gear wheel can be rotated by and with the pawl member in one direction as the winding shaft is caused to be rotated by the spiral spring.

7. A spring power unit as set forth in any of the preceding claims, wherein said winding shaft projects outwardly of one of said side walls and is provided, at its projecting end, with a knob so as to be capable of being manually rotated in one direction from the outside of said housing to wind up said spiral spring.

8. A spring power unit as set forth in any of the preceding claims, wherein said housing is composed of a pair of housing sections each having a side wall and a partition wall provided between the side walls to form together with the housing sections two chambers in said housing for separately housing said gear train and said spiral spring and wherein said housing sections and said partion wall are secured together without the use of individual fastening members, such as screws or the like.

9. A spring power unit as set forth in claim 8, wherein said housing sections and said partition wall are secured together by means of pins projecting inwardly from one of the housing sections, cylinders projecting inwardly from the other of the housing sections, resilient lugs projecting inwardly from the one of the housing sections and recesses formed in the other of the housing sections, said pins extending through said partition wall and being fitted in said cylidners, respectively and said resilient lugs being resiliently engaged at their engaging portions with said recesses, respectively.

10. A spring power unit as set forth in any of the preceding claims, wherein said partition wall is provided with a lug which restricts expansion of said spiral spring to some extent.

11. A spring power unit as set forth in any of the preceding claims, characterised in that it is constructed in a miniature size so that it may be suited for such a small toy as can be easily gripped by the hand of a child.

12. A spring power unit substantially as hereinbefore described with reference to the accompanying drawings.

For the Applicants
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