

Feb. 25, 1941.

W. J. DAILY ET AL

2,233,075

SPRING MOTOR

Filed June 17, 1938

FIG. 1.

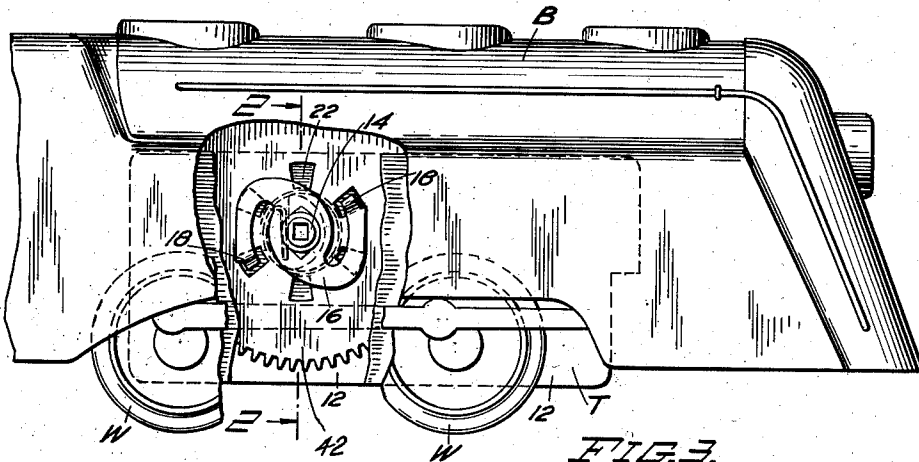


FIG. 2.

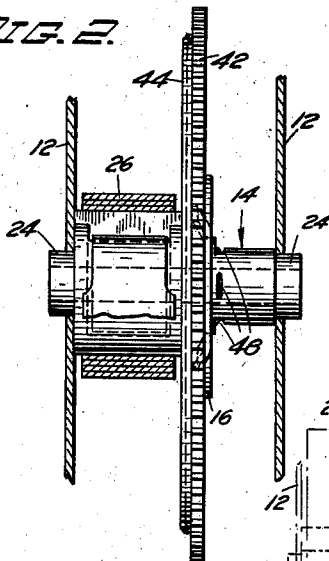


FIG. 3.

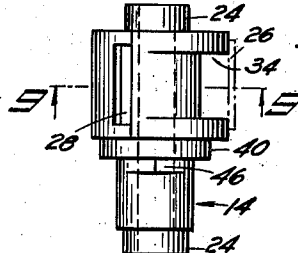


FIG. 5.



FIG. 4.

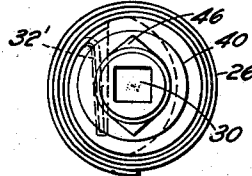


FIG. 7.

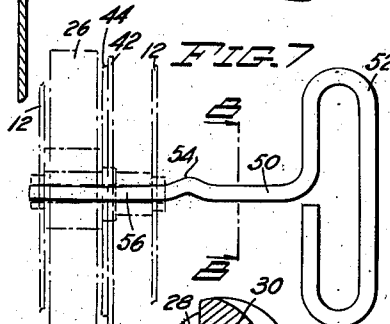


FIG. 8.

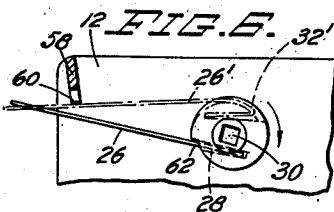


FIG. 9.

INVENTORS
WILLIAM J. DAILY
ANTHONY N. SMITH
BY
James F. Franklin
ATTORNEY

UNITED STATES PATENT OFFICE

2,233,075

SPRING MOTOR

William J. Daily and Anthony N. Smith, Girard,
Pa., assignors to Louis Marx & Company, Inc.,
New York, N. Y., a corporation of New York

Application June 17, 1938, Serial No. 214,394

13 Claims. (Cl. 185—45)

This invention relates to toys, and more particularly spring motor driven toys, and to a spring motor therefor.

The primary object of our invention is to generally improve toys, and more particularly spring motors for driving the same. A more particular object is to greatly reduce the number of parts required at the winding stem and main spring of the toy with a view to reducing the cost of manufacture of the spring motor. Still another object is to avoid the necessity for using a threaded connection between the key and the winding member, or bushing, or hub of the main spring, while at the same time providing a readily detachable key so that the toy may be packaged more compactly in a small container, and also, so that the key may be removed out of the way during operation of the toy or unwinding of the motor.

Further objects of the invention are to provide spring motor mechanism which will be characterized by a long operating life despite rough handling of the toy, and which will function successfully with a long stiff spring such as is needed for a toy railroad locomotive or other toy where a high torque must be developed for a long operating period. Another object is to provide a winding hub for the spring motor which will keep the spring centralized and in substantially circular condition concentric with the winding key despite the use of an attaching hook at the end of the spring formed by simply bending the metal ribbon reversely on itself. A still further object is to facilitate assembly of the spring with the hub, and more particularly, to make possible the formation of the hook at the end of the spring while winding the spring around the hub.

Further objects of the invention center about the winding key itself and are to provide an inexpensive key formed by simply bending a non-circular wire to key shape, the wire preferably being square wire. A sharp bend may be provided on the shank of the key acting as a stop to limit insertion of the key, and the shank of the key may, if desired, be given a slight curvature to provide a frictional fit between the key and the hub. The hub is a relatively massive and preferably die-cast element which is journaled directly in the side plates of the motor frame, and which has a square passage therein for the key. This passage preferably extends all the way through the hub from end to end, thus facilitating manufacture of the hub and permitting interlocking engagement of

the key and hub throughout a substantial length of material, including an interengagement directly within the point of winding of the main spring or the point of application of the load which is resisting turning of the key. Moreover, this arrangement makes it possible to use the motor universally in a variety of toys because the key may be slidably and detachably applied to the motor from either side of the motor. The main gear, ratchet wheel, and ratchet plate are all assembled directly on the hub in a convenient and sturdy manner.

To the accomplishment of the foregoing and such other objects as will hereinafter appear, our invention consists in the spring motor elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawing, in which:

Fig. 1 is a side elevation of a locomotive toy actuated by means of a spring motor embodying features of the present invention, a part of the locomotive body and of the motor frame being cut away to reveal the ratchet mechanism of the motor;

Fig. 2 is an enlarged section taken in elevation in the plane of the line 2—2 of Fig. 1;

Fig. 3 is a plan view of the winding hub;

Fig. 4 is an end view of the same with some convolutions of the spring shown therearound;

Fig. 5 illustrates the ends of the spring;

Fig. 6 is explanatory of the method in which the spring is wound in place;

Fig. 7 is a front elevation of the key;

Fig. 8 is a transverse section taken in the plane of the line 8—8 of Fig. 7; and

Fig. 9 is a section taken in the plane of the line 9—9 of Fig. 3.

Referring to the drawing, and more particularly Fig. 1, the invention is shown applied to a toy locomotive comprising a locomotive body B mounted on a motor truck T running on flanged locomotive wheels W. The locomotive is driven by a spring motor carried within the frame or side plates 12 of the truck, said side plates acting also as a frame for the spring motor, as is usually the case in these toys. The spring motor is generally conventional and need not be described in detail other than to say that it includes a hub 14 about which a ribbon-like spring is spirally wound. The hub turns appropriate ratchet mechanism, here illustrated by a ratchet plate 16 secured to hub 14 and having a pair of pawls or dogs 18 urged resil-

iently against the side face of a main gear 42. The main gear is cut away to form a series of openings 22 which function as a ratchet wheel. It will be understood that the main gear meshes with an intermediate pinion, which in turn is fixed to an intermediate gear, which in turn drives another pinion, and so on, until the desired step-up ratio is obtained between the hub 14 and the driving wheels W. Moreover, in accordance with conventional practice, additional step-up gears may be provided leading up to a suitable governor for controlling the speed of unwinding of the spring motor.

It may not be amiss to point out that the spring motor, although here shown applied to a locomotive toy, may be applied to any of a variety of toys, and that the locomotive toy has been selected merely by way of illustration rather than limitation of the invention.

The present invention centers about the hub 14 and associated mechanism. Referring to Figs. 2, 3, and 4, the hub 14 is preferably a single unitary member formed to finished or substantially finished configuration and dimension by die-casting practice. It is formed with journals 24 at its ends, these journals being received between the side plates or frame plates 12 of the motor. The hub is enlarged to receive the main spring 26, and this enlargement is spiral in configuration, as is shown in Fig. 4 and perhaps better shown in Figs. 6 and 9. The enlarged part of the hub is provided with a slot 28 which extends across the hub in a tangential direction or at an angle such as to clear the centermost part or key-receiving passage 30 of the hub. This slot 28 may extend all the way through the hub, but is preferably terminated or blind, as shown in Fig. 9, in order to limit the insertion of the end of the spring when beginning to wind the spring in place.

The spiral configuration of the hub allows room for the hook or bend of the main spring and is so shaped as to tend to keep the succeeding convolutions of the spring approximately circular and concentric with the axis of the hub. A part of the hub may be cut away, as is indicated at 34 in Figs. 3 and 9, but this is merely to conserve the amount of metal used in the hub, and the hub may, of course, be solid at this point. It should be understood that the cut-away portion 34 is narrower than the spring 26, and the spring therefore rests on the outside of the hub, as is indicated by the broken line section marked 26 in Fig. 3.

Next to the enlarged spring-receiving portion 55 of the hub, the hub is provided with a circular journal 40 which rotatably receives the main gear 42 of the spring motor. In the present case, the main gear 42 is stamped out of heavy gauge sheet metal and it is associated with a dished stiffening or reinforcing plate 44, and the parts 44 and 42 are together received on the journal 40 and are rotatable thereon.

Next to journal 40, the hub is provided with a non-circular portion 46 which in the present case is somewhat diamond or lozenge shaped in outline, as is best shown in Fig. 4. The ratchet plate 16, previously referred to in connection with Fig. 1, is provided with a matingly shaped opening. The ratchet plate is forced over the part 46 of the hub, thus effectively preventing any relative rotation of the plate and hub. The ratchet plate is held against axial movement off the part 46 by staking or riveting a part of the hub outwardly, as is indicated at 48 in Fig. 2. Because of the manner in which the parts of the hub

are successively stepped, it will be seen that the main gear is also held against axial movement, it being disposed between the enlarged spring bearing part of the hub and the ratchet plate 16. The stepping of the hub is also such as to prevent axial movement of the hub relative to the motor frame plates 12, as will be seen by reference to Fig. 2.

The hub is provided with a non-circular socket 30 to receive the winding key. In the present case, the socket or passage is square in section, and the key 50 is bent up out of square wire. It consists essentially of a shank which may be slidably pushed into the passage 30, and a handle portion 52. The shank may, if desired, be sharply bent at 54 to form a stop for limiting insertion of the key. Moreover, the working part 56 of the shank of the key may be given a very slight curvature, as is shown in Fig. 7, thus creating a frictional fit of the key within the opening 30 when the key is pushed into the hub. In the present case, the passage 30 extends entirely through the hub from end to end. This is not essential, but it is convenient both in manufacturing the hub and also in subsequently using the same, for the key may be applied to the motor from either side. The mating parts of the key and hub include a portion directly within the main spring so that the winding stress is applied directly to the spring.

The spring may be wound in place in a very simple manner which is explained with reference to Fig. 6. In that figure, it will be seen that the side plates 12 of the motor are connected at one corner by a cross-bar 58 having a downwardly projecting tongue 60. The spring 26 has its inner end inserted into the slot 28 of the hub, as is shown in the solid line position of Fig. 6. It is not necessary to preliminarily form a hook on the end of the spring, although it is desirable to provide the spring with an annealed end. Referring for a moment to Fig. 5, it may be explained that the spring strip 26 has its inner end narrowed somewhat, as is indicated at 62, and this narrowed end is annealed or softened. The outer end is preferably provided with a slot or aperture 64.

To avoid confusion, it may be mentioned that the inner end 62, although narrowed slightly to fit readily in slot 28, is not narrowed enough to fit in the cut-out space 34 on the opposite side of the hub. Ordinarily, the narrowed part 62 is not long enough to reach the cut-out 34, and in any event, even if it does reach the cut-out 34, its width is great enough to straddle the raised parts of the hub.

Reverting now to Fig. 6, after the end 62 of spring 26 has been inserted in slot 28, the hub is turned as by means of a winding key, thus turning the hub and spring from the solid line position of Fig. 6 to the broken line position 26', at which time the spring is bent to form the anchoring hook 32'. The winding of the spring is then proceeded with until the end of the spring reaches the cross-member 58, whereupon the slot 64 springs over the tongue 60, thereby anchoring the spring in position for future use of the toy.

It is believed that the construction and operation, as well as the many advantages of our improved spring motor construction, will be apparent from the foregoing detailed description thereof. The number of parts required at the main spring of the motor is reduced to a minimum, and the single unitary hub is produced inexpensively by die-casting. The key is detach-

able and is readily slid into or removed from the hub. No threaded connection or screw machine parts are required. The key is held in place with a slight friction adequate to prevent it from falling out of the hub unintentionally. The key may be inserted in the hub from either side of the motor.

The new hub assembly is characterized by long operating life; is adapted for use with relatively long stiff springs; keeps the convolutions of the spring approximately circular and concentric with the hub; and facilitates assembly of the spring and hub. In fact, it makes it possible to form the hook at the inner end of the spring as a part of the initial winding operation. The key is itself inexpensive, it being bent up out of square wire stock. The hub is itself journaled directly in the side plates of the motor frame, thus affording large diameter adequate bearings. The winding force of the key is applied throughout the length of the hub, thus distributing the load and applying it immediately within the spring itself. The main gear and ratchet plate are assembled on the hub by a simple staking operation and without the use of special additional parts. In this connection, it may be pointed out that the torque of the motor is not applied to the staking or upsetting of the hub. The torque or main force is taken through the non-circular or approximately diamond or lozenge shaped part of the hub, and the keying of the ratchet plate to the hub is strong beyond anything required in the course of operation of the motor. The only load on the upset or staked part of the hub is the slight axial spring load caused by movement of the ratchet dogs into and out of the ratchet openings in the main gear. This load is comparatively light. Motors embodying the invention as here disclosed have been tested to destruction and no breakdown at the hub construction has been encountered.

It will be apparent that while we have shown and described our invention in a preferred form, many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention defined in the following claims.

We claim:

1. A toy spring motor comprising a frame, a hub having journals received in said frame, a spring wound about said hub and having its inner end connected to the hub and its outer end connected to the frame, and a winding key having a substantially straight solid end, said hub having a non-circular passage therein to slidably receive the winding key, said winding key having a section freely slidably mating with that of the passage in the hub, but being slightly curved to engage the hub with a frictional fit.

2. A toy spring motor comprising a frame including spaced frame plates, a hub having journals received in bearings formed in the frame plates, a spring wound about said hub and having its inner end received in a slot in said hub and having its outer end connected to the frame, and a winding key, said hub having a square passage therein adapted to receive the winding key, said winding key being formed by bending a piece of wire of square section into key shape, the square wire of said key being slidably but non-rotatably receivable in the square passage through the hub, the shank of said key being slightly curved so that the key is received in the hub with a frictional fit.

3. A toy spring motor comprising a frame including spaced frame plates, a hub made of die-cast metal and having journals at its ends which are received in bearings formed in the frame plates, a spring wound about said hub and having its inner end received in a slot in said hub and having its outer end connected to the frame, and a winding key, said hub having a square passage extending all the way through the hub from end to end and adapted to receive the winding key, said winding key being formed by bending a piece of wire of square section into key shape to provide a nearly straight shank and a handle at one end thereof, the shank of said key being sharply reversely bent at a point intermediate the free end and the handle in order to form a stop for limiting insertion of the key in the hub.

4. A toy spring motor comprising a frame, a hub formed of die-cast metal and having a spiral portion with a slot extending therein for receiving the end of a spring wound outside said hub, said slot starting at the smaller radius portion of the spiral to help wind the spring centrally, and journals on said hub received in the frame.

5. A toy spring motor comprising a hub having a spiral portion with a slot extending therein for receiving the end of a spring, said slot starting at the smaller radius portion of the spiral to help wind the spring centrally, a circular journal on said hub for receiving the main gear and ratchet wheel of the motor, and a non-circular part on said hub for receiving the ratchet plate of the motor.

6. A toy spring motor comprising a hub formed of die-cast metal and having a spiral portion with a slot extending therein for receiving the end of a spring, said slot starting at the smaller radius portion of the spiral to help wind the spring centrally, the larger radius portion of the spiral being cut away at the center, a circular journal on said hub for receiving the main gear and ratchet wheel of the motor, and a non-circular part on said hub for receiving the ratchet plate of the motor, a part of the hub metal being riveted or staked to hold the ratchet plate in position and to thereby hold the main gear on its journal.

7. A toy spring motor comprising a non-rotatable frame including spaced frame plates, a hub having journals received in bearings formed in the frame plates, said hub having a spiral portion with a slot extending therein for receiving the end of a spring, said slot starting at the smaller radius portion of the spiral, a spring wound about the outside of said hub and having its inner end received in the slot in said hub and having its outer end connected to the frame, said hub having a non-circular passage therein adapted to slidably receive a removable winding key also having a non-circular cross-section which is non-rotatable in the passage.

8. A toy spring motor comprising a hub having a spiral portion with a slot extending therein for receiving the end of a spring, said slot starting at the smaller radius portion of the spiral, a circular journal on said hub for receiving the main gear and ratchet wheel of the motor, a non-circular part on said hub for receiving the ratchet plate of the motor, a spring wound about said hub and having its inner end received in the slot in said hub and having its outer end connected to the frame, and a readily removable

winding key, said hub having a square socket adapted to slidably receive the key, said winding key being formed by bending a piece of square wire into key shape.

5 9. A toy spring motor comprising a non-rotatable frame including spaced frame plates, a hub made of die-cast metal and having journals which are received in bearings formed in the frame plates, said hub having a spiral portion
10 with a slot extending thereinto for receiving the end of a spring, said slot starting at the smaller radius portion of the spiral in order to help keep the spring central, a circular journal on said hub for receiving the main gear and ratchet
15 wheel of the motor, a non-circular part on said hub for receiving the ratchet plate of the motor, a spring wound about said hub and having its inner end received in the slot in said hub and having its outer end connected to the frame, and
20 a readily removable winding key, said hub having a square passage extending all the way through the hub from end to end and adapted to slidably receive the winding key, said winding key being formed by bending a piece of square wire into
25 key shape.

10. A winding key made of a piece of wire of square section bent into key shape, the shank of said key being slightly curved so that the key is received in a receptive socket with a frictional
30 fit.

11. A toy spring motor comprising a non-rotatable frame including spaced frame plates, a hub extending between said frame plates and having journals at its ends rotatably received in bearings formed in the frame plates, the ends of said
35 journals passing through said frame plates and being exposed at the outside of the frame on both sides, a spring wound about said hub and having its inner end received in a slot in said hub and having its outer end connected to the frame, and a readily removable winding key, said
40 hub having a non-circular passage extending all the way therethrough and adapted to axially

slidably receive the winding key, said winding key being formed by bending a piece of wire of non-circular section into key shape, the wire of said key being slidably but non-rotatably receivable in the passage through the hub, the cross-sectional dimension of said passage and key being smaller than the diameter of said journals, said passage passing through the ends of said journals and being thereby exposed at the outside of the frame for insertion of the key. 5 10

12. A toy spring motor comprising a non-rotatable frame, a hub formed of die-cast metal and having a spiral portion with a slot extending thereinto for receiving the end of a spring wound outside said hub, said slot starting at the smaller
15 radius portion of the spiral to help wind the spring centrally, journals on said hub received in the frame, and a non-circular passage extending axially through said hub and through at least one of said journals where it is exposed outside the frame for sliding reception of the shank of a detachable winding key of non-circular section, said slot for said spring being offset from the axis of the hub enough to clear said passage for reception of the key. 20 25

13. A toy spring motor comprising a hub having a spiral portion with a slot extending thereinto for receiving the end of a spring wound around the outside of said hub, said slot starting at the smaller radius portion of the spiral to
30 help wind the spring centrally, a circular journal on said hub for receiving the main driving gear and ratchet wheel of the motor, a non-circular part on said hub for receiving the ratchet plate of the motor, and a non-circular passage extending
35 axially of said hub for the sliding reception of the shank of a winding key of non-circular section, said slot for said spring being offset from the axis of the hub enough to clear said passage for reception of the key. 40

WILLIAM J. DAILY.
ANTHONY N. SMITH.