United States Patent [19]

Darda

[11] **Patent Number: 4,832,156**

[45] **Date of Patent: May 23, 1989**

[54] **SPRING MOTOR**

[76] Inventor: **Helmut Darda**, 7712 Blumberg, Fed. Rep. of Germany

[21] Appl. No.: **149,448**

[22] Filed: **Jan. 28, 1988**

[30] **Foreign Application Priority Data**

Jan. 28, 1987 [DE] Fed. Rep. of Germany 3702457

[51] **Int. Cl.**[4] **F03G 1/06**; F16H 27/00; G04B 15/12

[52] **U.S. Cl.** **185/38**; 74/1.5; 185/DIG. 1; 368/134; 368/181; 446/464

[58] **Field of Search** 74/1.5; 185/5, 31, 38, 185/DIG. 1; 368/124, 125, 134, 137, 181, 138; 446/464

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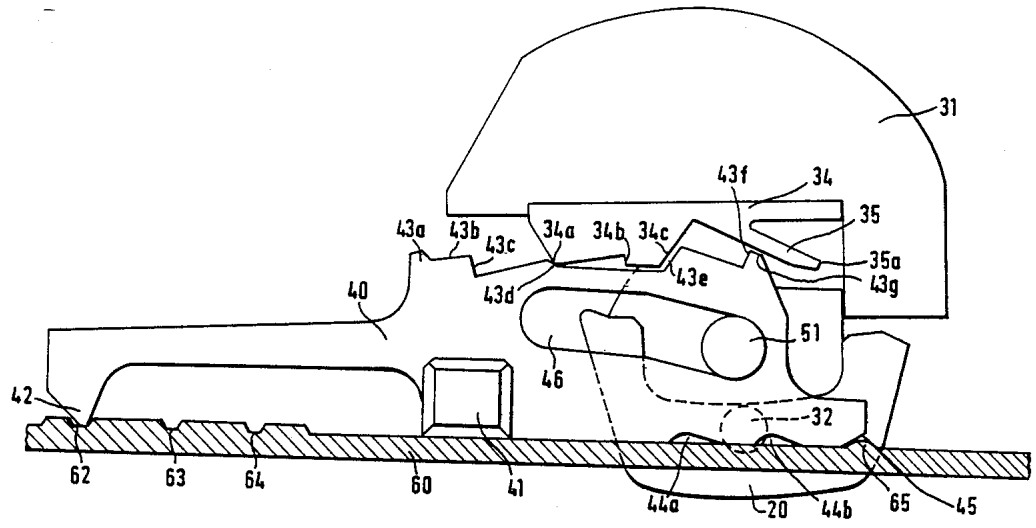
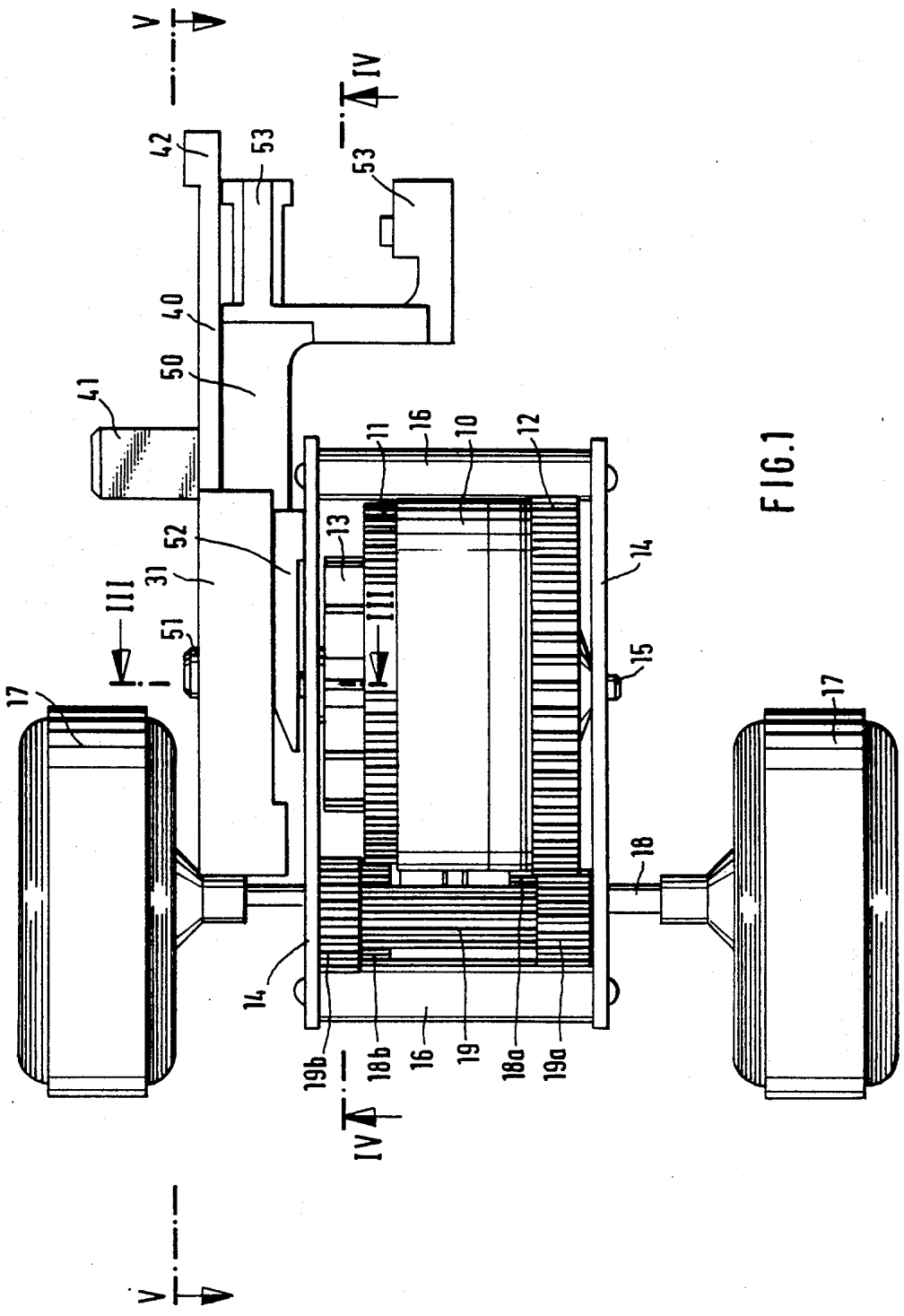
Primary Examiner—Allan D. Herrmann
Attorney, Agent, or Firm—Irvin A. Lavine

[57] **ABSTRACT**

A braking device is provided to reduce the speed at which a shiftable spring motor runs down. The braking device includes a pallet which is mounted so that it can oscillate, the pallet having a pair or arms which cooperate with the teeth of an escape wheel **13** which rotates as the spring runs down. The pallet is connected to a pendulum weight. The depth of engagement of the arms of the pallet in the teeth of the escape wheel as well as the amplitude of oscillation of the pallet and/or the pendulum weight connected therewith allow the braking action to be changed and hence the speed at which the motor runs down in one of a plurality of selectable shift positions.

6 Claims, 9 Drawing Sheets

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IV
42
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16
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52
31
III
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III
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14
19b
18b
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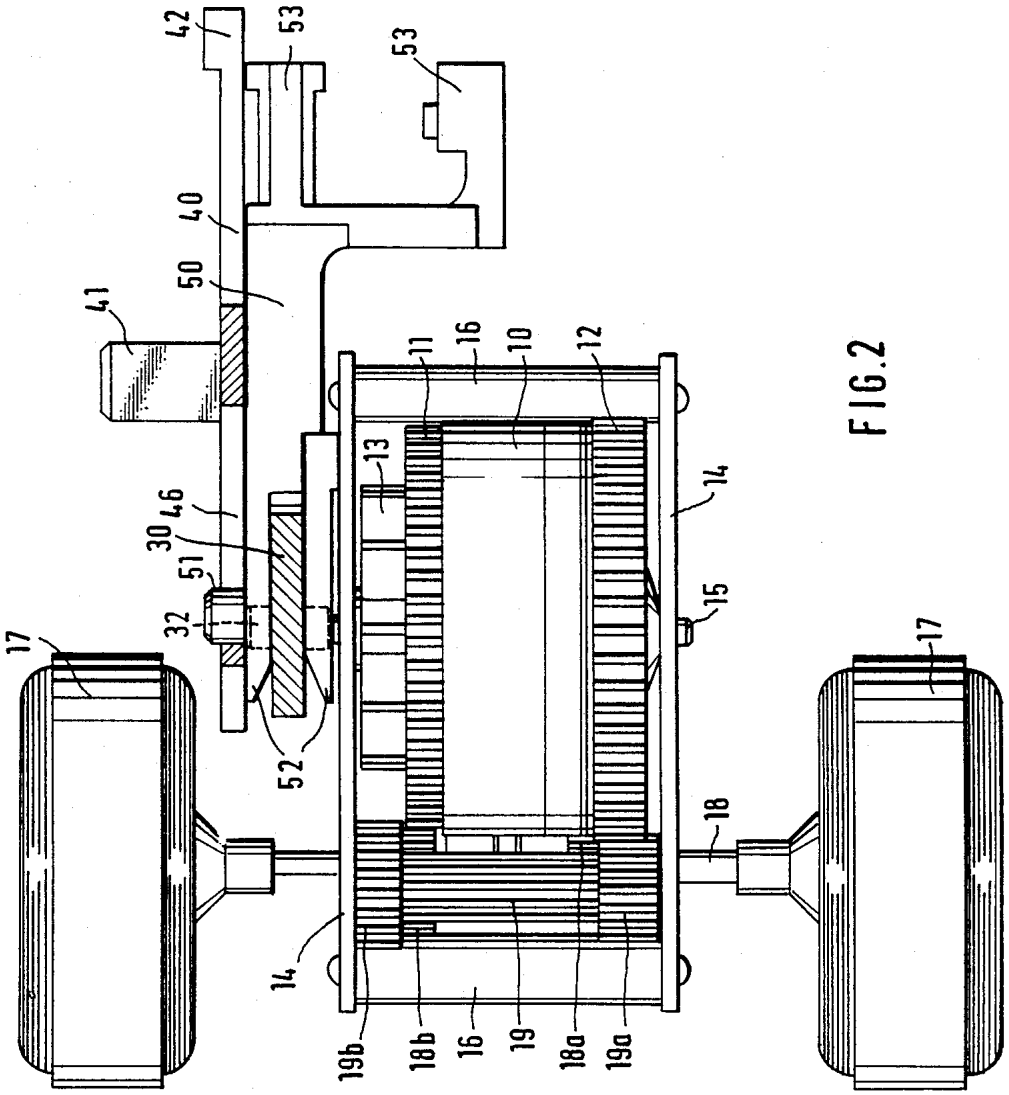
18a
19a
IV
V

FIG.1


42
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46
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52
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14
19b
18b
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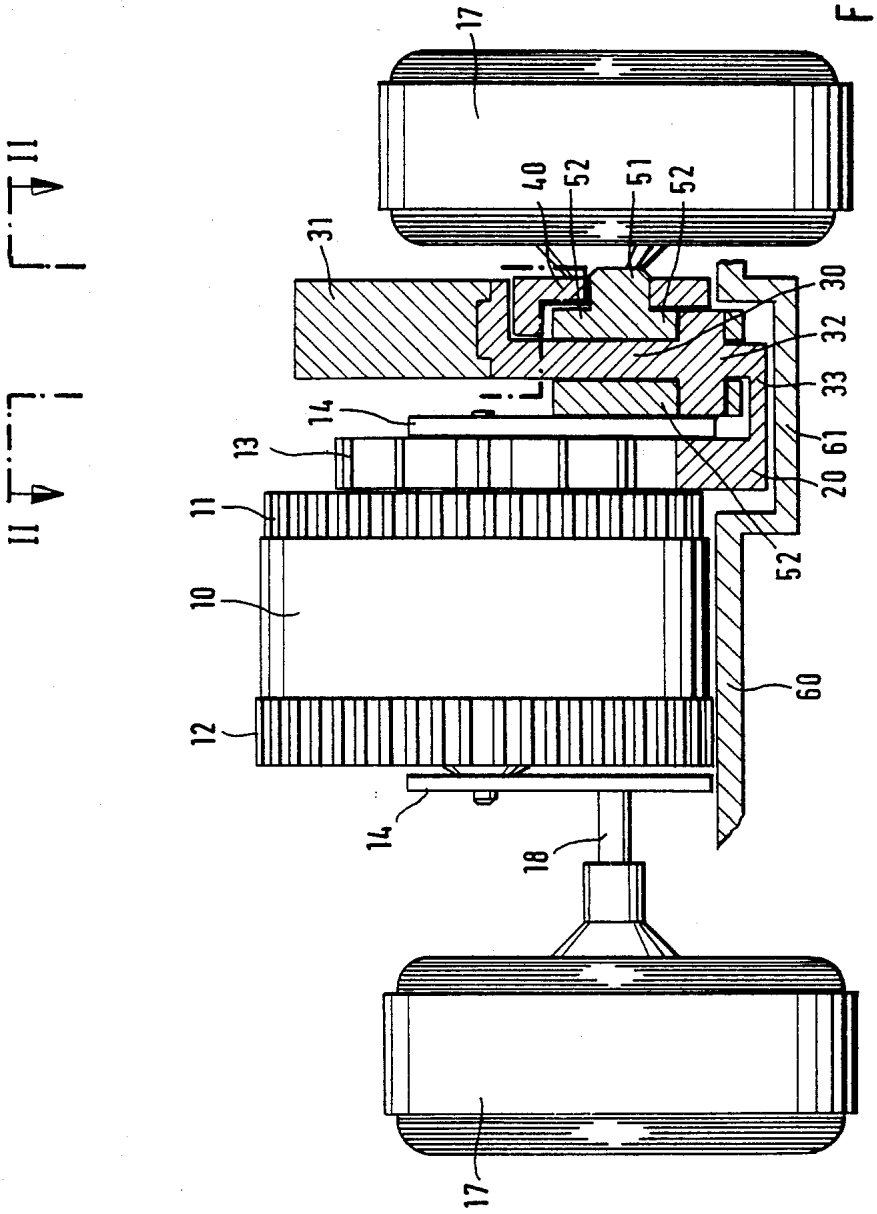
18a
19a

FIG.2

FIG. 3



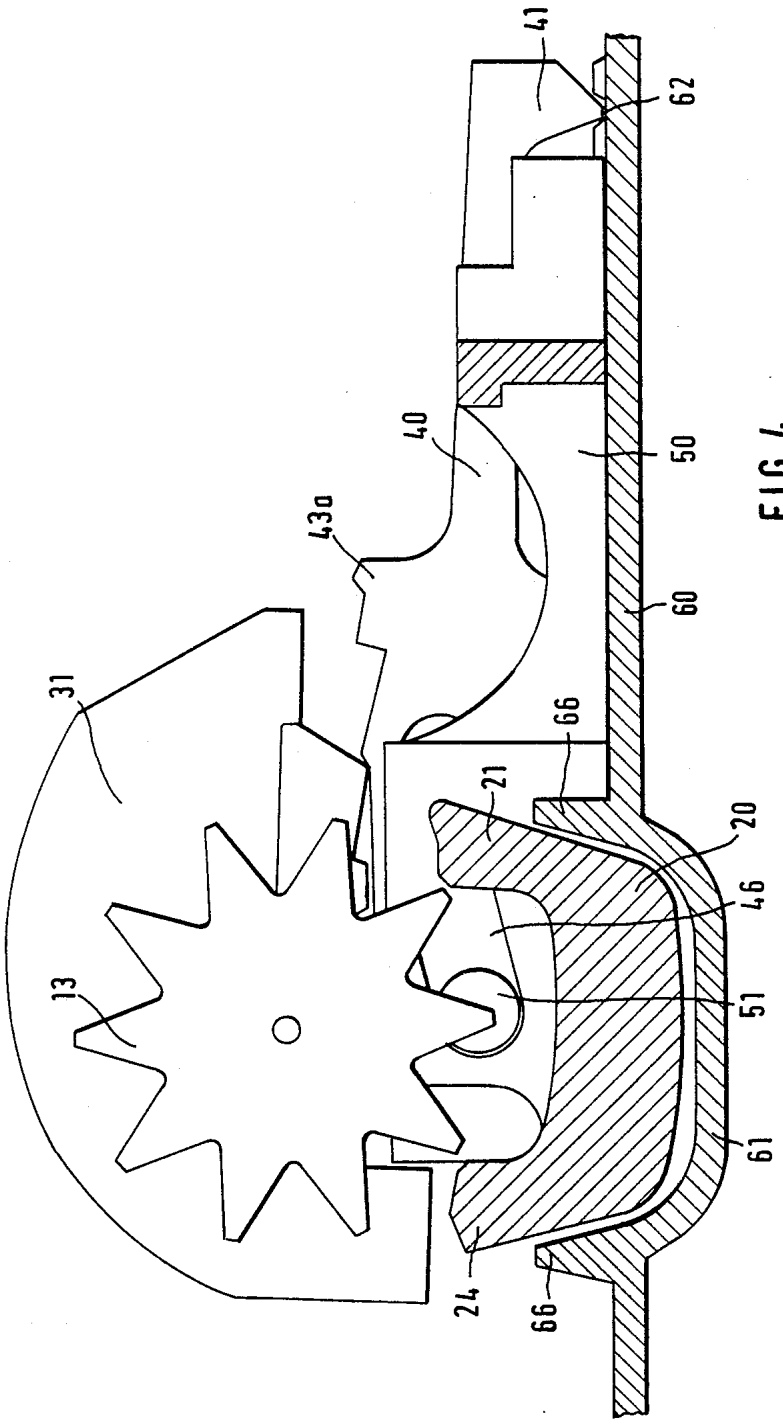


FIG.4

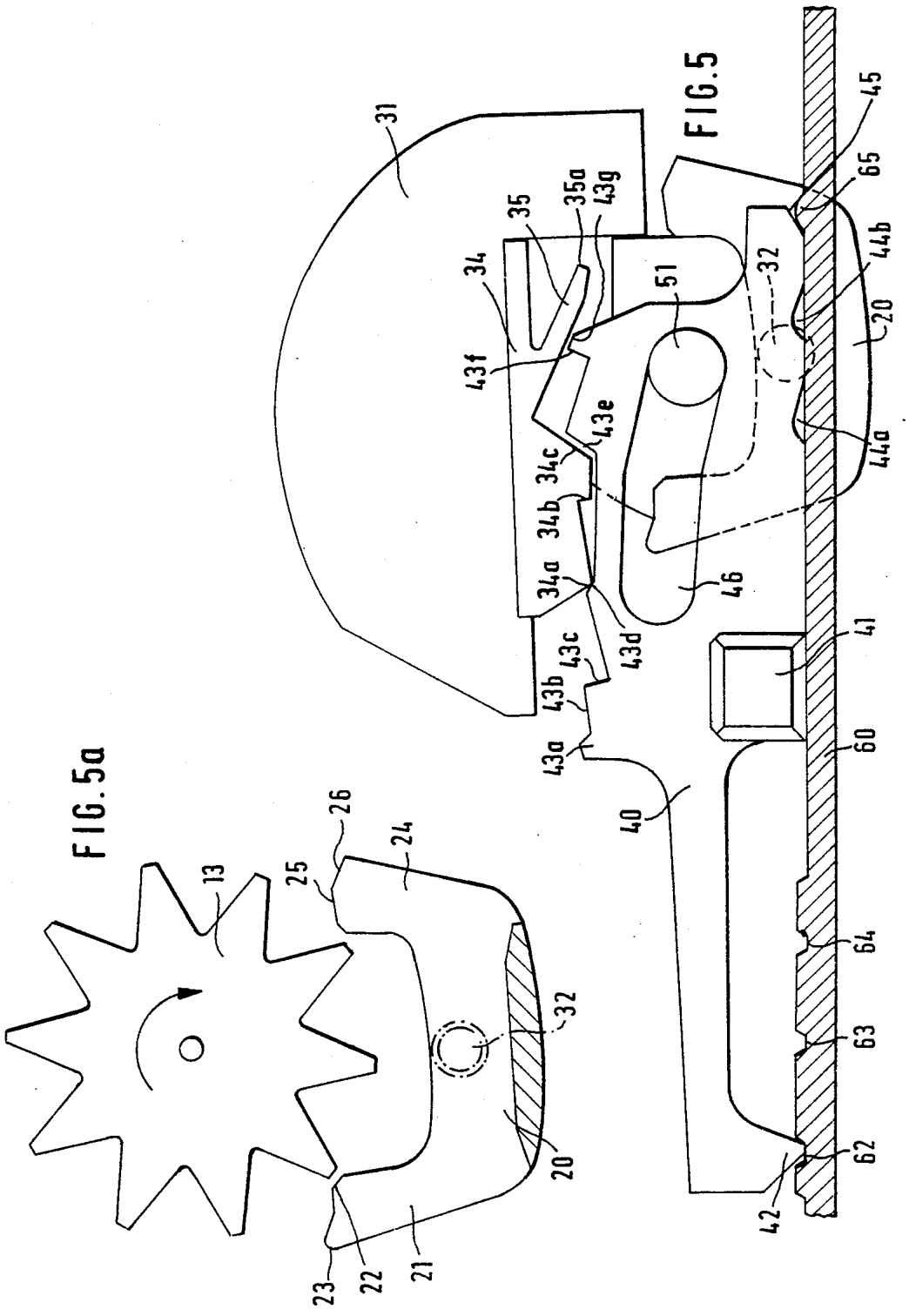


FIG.5
FIG.5a
31
35
35a
43g
34
51
32
45
65
44b
20
431
43e
34c
34b
34a
44a
46
43d
43c
43b
43a
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64
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42
26
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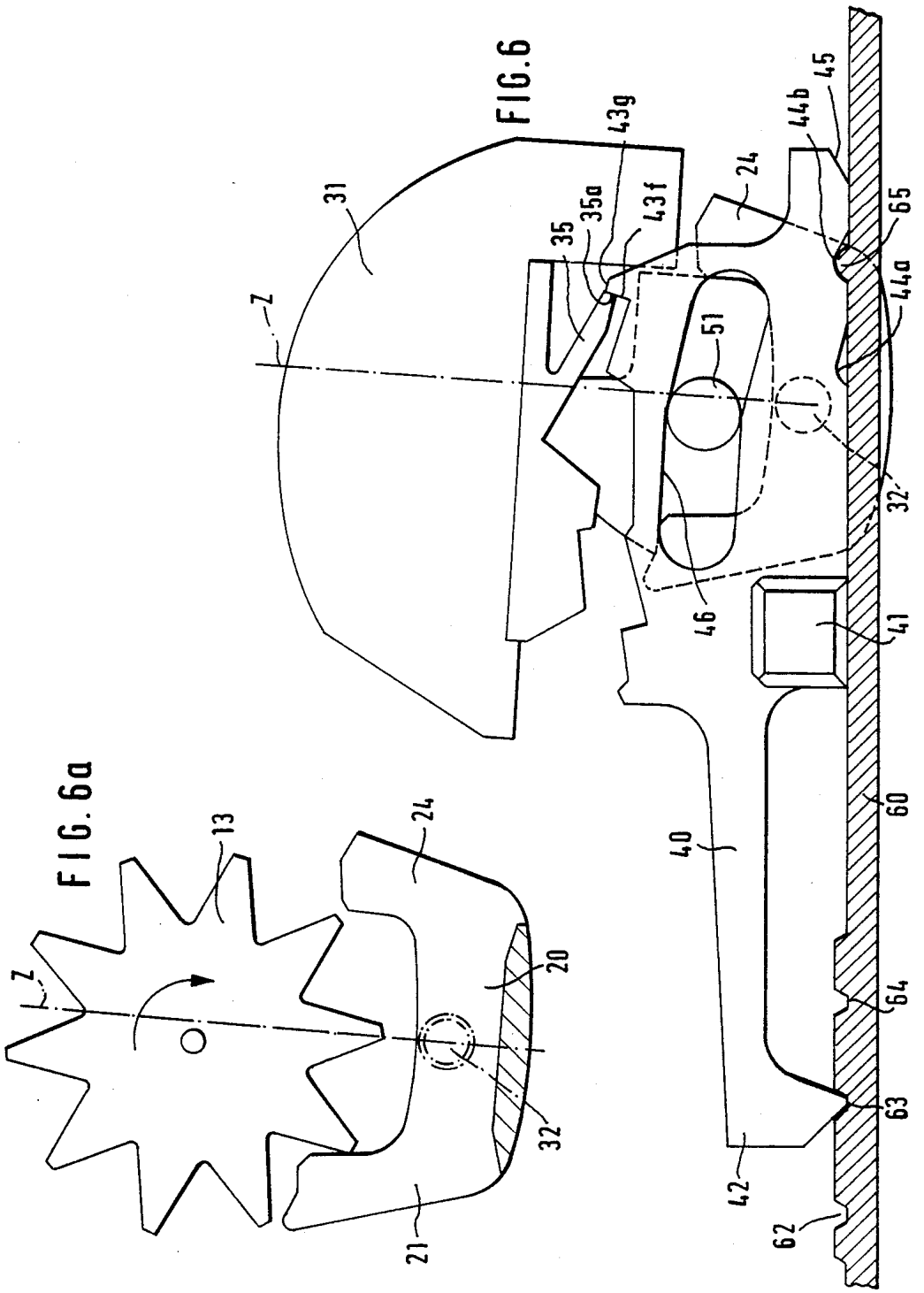
FIG.6
FIG.6a
31
43g
35
35a
43f
24
44b
45
65
44a
51
32
46
41
40
60
64
63
42
62
13
20
21
Z

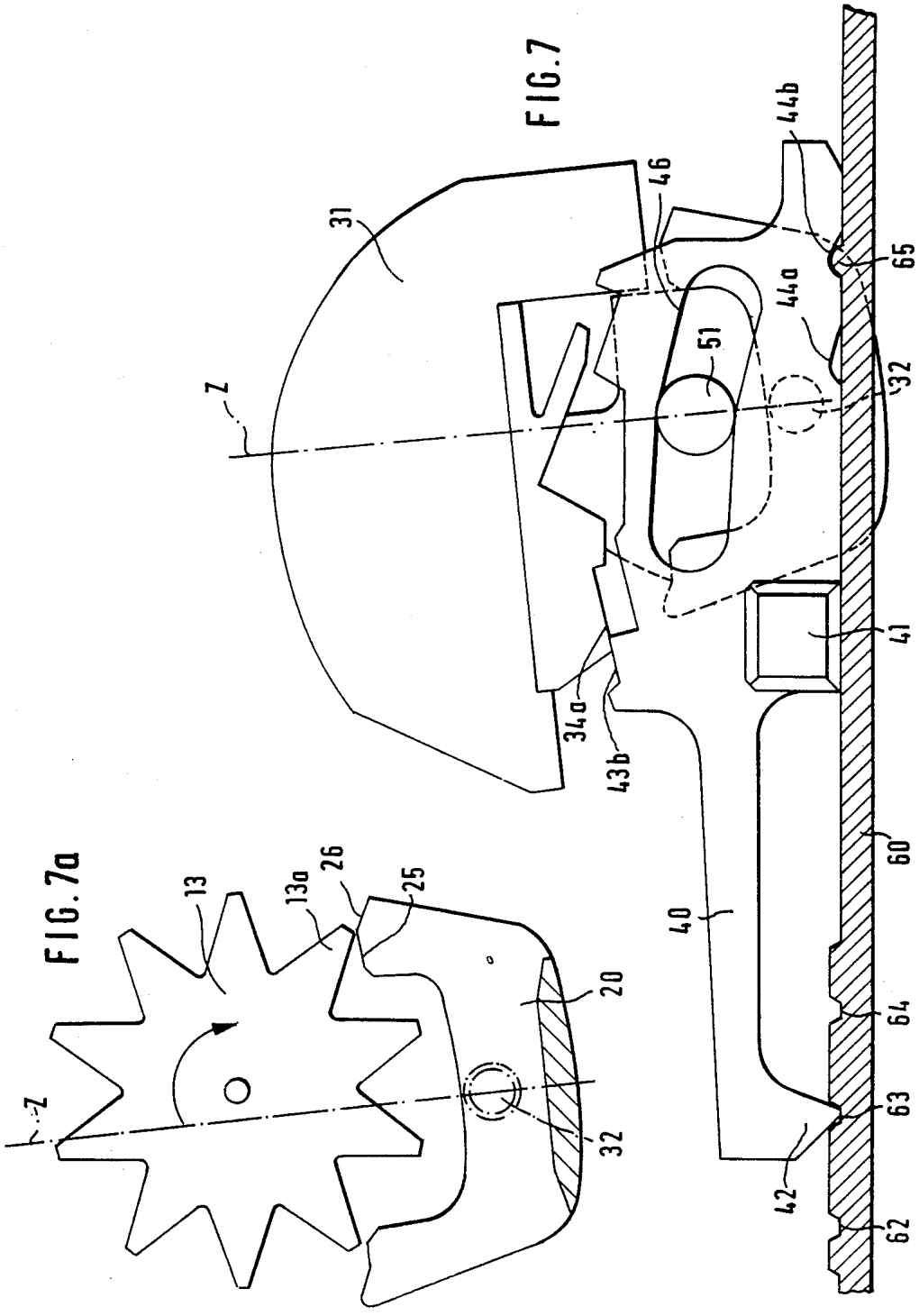
FIG.7
FIG.7a
31
46
44b
65
44a
51
32
Z
41
34a
43b
60
40
64
63
42
62
20
13
13a
26
25

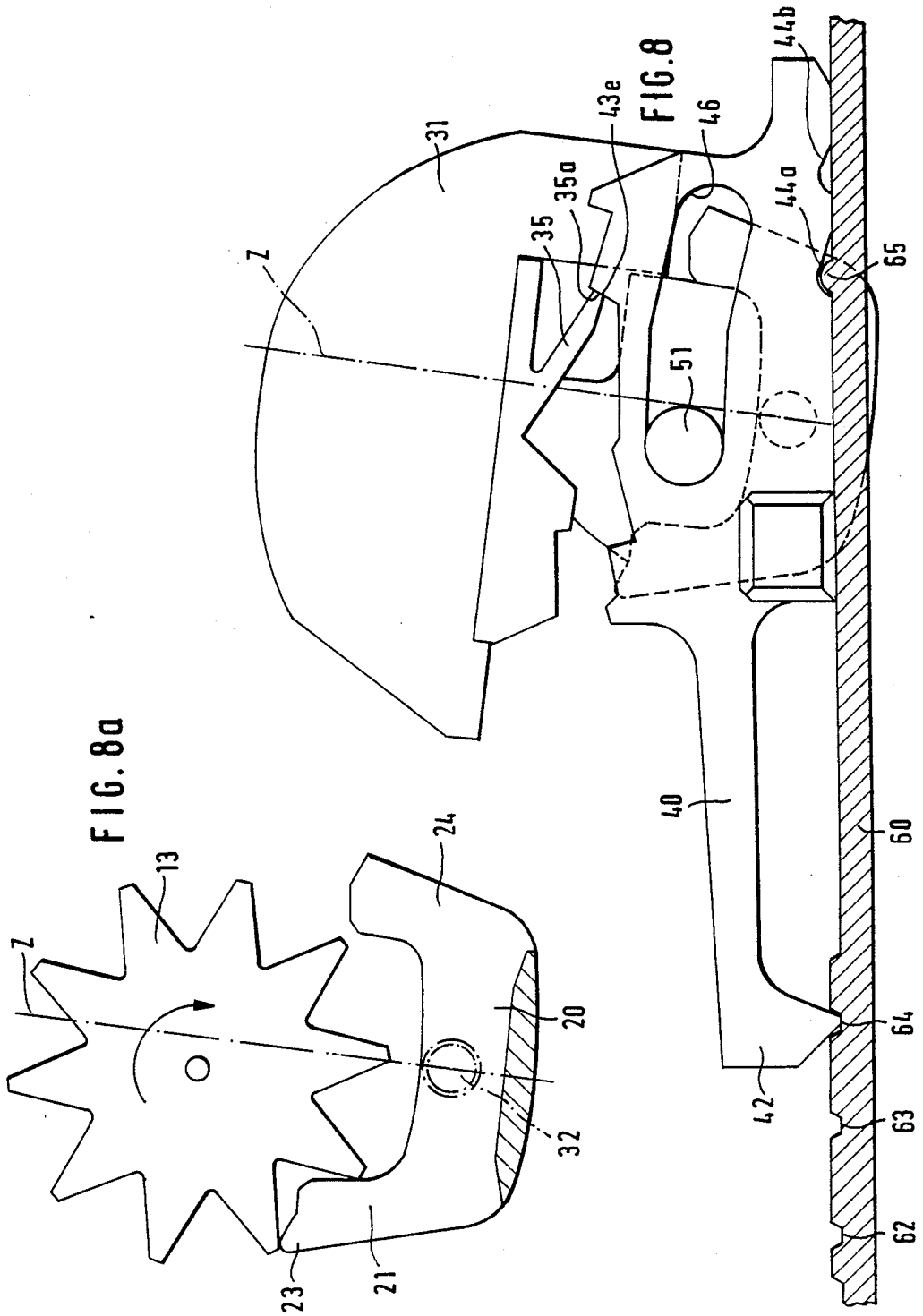
FIG.8
FIG.8a
31
43e
46
44b
35a
35
44a
65
Z
51
40
60
64
42
63
62
24
13
20
32
23
21

FIG. 9

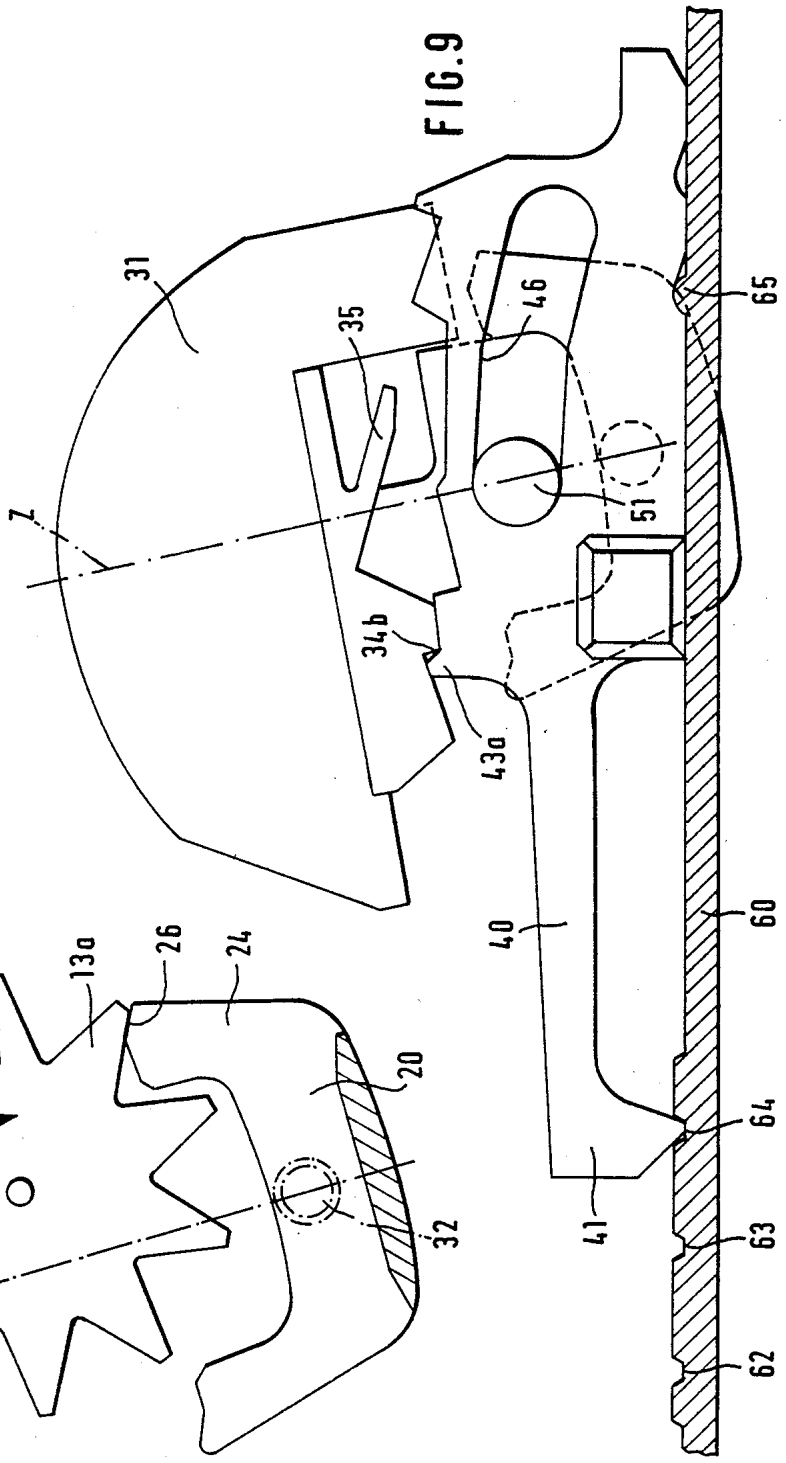

FIG. 9a

SPRING MOTOR

BACKGROUND OF THE INVENTION

The invention relates to a spring motor whose function is essentially described in U.S. Pat. No. 2,812,933, corresponding to German Patents 2 019 085 and 2 039 265; U.S. Pat. No. 3,981,098, which includes also the disclosure of German Patent 21 05 734, and to U.S. Pat. No. 4,053,029 which includes subject matter of German Patent 21 66 490 and whose especially preferred embodiment is described in German Patent 24 61 625, said patents relating to inventions by the same applicant.

Spring motors of this type are preferably used in very small toy cars because of their compact design.

These spring motors have a comparatively simply designed differential transmission, especially suitable for driving fast-moving toy cars.

The goal of the present invention is to modify and/or improve upon this motor in such fashion that it is also suitable for driving slow-moving toy cars or can be simply adapted to toy cars with modified dimensions or weights.

German Patent 21 66 888 has proposed providing an additional step-down transmission in a toy car of the same species, between the drive shaft of the spring motor itself and the drive shaft of the car, in order to reduce the traveling speed thereby.

Although this solution is feasible, it is unsuitable for economically priced small toy cars if this transmission is also to be shiftable.

Moreover, this step-down transmission cannot be integrated into the spring motor disclosed in U.S. Pat. No. 4,053,029 and in German Patent 24 61 625 without a significant change.

SUMMARY OF THE INVENTION

To achieve the above goal, the influence on the speed is not accomplished by reducing the rotational speed of the drive shaft in known fashion by using a shiftable step-down transmission, but by employing an adjustable braking device which influences the speed at which the spring motor winds down. Braking devices used in clockmaking are suitable, in which devices the drive shaft of the spring motor is connected to a shift or escape wheel, which cooperates with a pallet mounted so that it oscillates, the arms of said pallet alternately engaging the teeth of the escape wheel.

By changing the braking action, for example, by changing the depth of engagement of the pallet and the escape wheel, the speed at which the motor runs down can be regulated continuously over a set range.

This has previously been described in German Patent 376 510 in conjunction with a clock movement and in German Patent 867 351 in connection with a drive for a film camera.

It has been found that a braking device of this kind cannot sufficiently reduce the speed of a spring-driven toy car.

To achieve the stated goal, an engageable braking device is proposed according the invention for a spring motor including a coil spring which may be brought into driving relationship with a drive shaft through a transmission. The basic objective of the proposed solution is to change the oscillation amplitude of a pallet which cooperating with an escape wheel.

This permits relatively large shifting stages, so that by simple means, including staggered stops of the sides of the pallet associated with adjustable stops, clear shift positions, like the speeds of a shifting transmission of motor vehicles, can be achieved.

According to another object, the braking device according to the invention can be combined with a known braking device, used in clock movements and camera drives, providing additional possible variations.

It is advantageous for the designer who must provide toy cars having very different dimensions with a spring motor of the kind disclosed to be able to adjust the characteristics of the spring motor to the toy car without significant changes.

This purpose is served by mounting the pallet so that it can oscillate, and is additionally provided with a pendulum weight which is preferably fastened loosely and interchangeably to a pendulum. By replacing the pendulum weight which oscillates in the direction of travel of the toy car, the direction of travel of the free-running, i.e. not track-bound, vehicle can be influenced, something which is necessary for example if the direction of travel deviates undesirably from a straight line.

The invention as well as additional measures for working the invention are explained below with reference to an embodiment in detail with reference to the drawings.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a top view of the entire spring motor according to the invention;

FIG. **2** is a top view of the spring motor according to FIG. **1**, but showing the parts cut along line II—II in FIG. **3**;

FIG. **3** is a front elevation of the spring motor according to FIG. **1**, but with the sectional view shown in FIG. **1** along line III—III;

FIG. **4** is an enlarged cross section through the spring motor according to FIG. **1** along line IV—IV with an escape wheel shown not cut;

FIGS. **5–9** are schematic side views of the spring motor looking in the direction V—V in FIG. **1** with a sectioned bottom plate, showing the different shifting and oscillating positions of the braking device according to the invention;

FIGS. **5***a* to **9***a* are side elevations of the escape wheel and pallet in the positions corresponding to the shifting or oscillating positions shown in FIGS. **5–9**; in particular:

FIGS. **5**, **5***a* show the braking device in neutral (first shaft position);

FIGS. **6**, **6***a* show the braking device with a slight braking action (second shift position), with the pallet and the pendulum at the right-hand extreme of oscillation;

FIGS. **7** and **7***a* show the braking device according to FIG. **6** (second shift position) with the pallet and the pendulum at the left-hand extreme of oscillation;

FIGS. **8** and **8***a* show the braking device with its maximum braking action (third shift position), with the pallet and the pendulum at the right-hand extreme of oscillation; and

FIGS. **9** and **9***a* show the braking device according to FIG. **8** (third shift position), with the pallet and pendulum at the left-hand extreme of oscillation.

DETAILED DESCRIPTION OF THE DRAWINGS

The basic design of the spring motor whose operation is described in detail in the patent cited at the outset is as follows.

In FIG. **1**, a spring, not shown, is located in a closed spring housing **10**, the ends of said spring being connected at one end to spring housing gear **11** and at the other end to spring core gear **12**.

Gears **11** and **12**, rotating in opposite directions, are connected in driving fashion with one another by means of a so-called reversing pinion **19** which comprises pinions **19***a* and **19***b* rigidly connected with one another, and drive pinions **18***a* and **18***b* mounted on axle **18**, in such fashion that a torque is exerted on axle **18** which corresponds to the difference in the torque delivered by gears **11** and **12**. The arrangement of the gears is also such that the spring located in spring housing **10** is tensioned at a certain shift position by rotating axle **18** in both directions from the inner and outer ends simultaneously.

The parts of this spring motor known from the patents listed at the outset are mounted between motor plates **14** connected together by support **16**. The complete drive is pivotably mounted on bottom plate **60** by means of support **16** (at the right in FIG. **1**) which is located at the front, looking in the direction of travel. Spring housing **10** with gears **11** and **12** is rotatably mounted by means of its shaft **15** between plates **14**.

The device according to the invention slows down the rate at which the spring motor runs down, with the degree of retardation being adjustable.

This is acomplished by the braking mechanism according to the invention which consists of an escape wheel **13** permanently attached to spring housing gear **11** and a pallet **20** cooperating therewith (see FIGS. **3** and **4**), said pallet in turn being connected by part **33** and pendulum **30** with pendulum weight **31**.

Pendulum **30** is mounted so that it can oscillate by means of pendulum axis **32** between arms **52** of a pendulum fork **50**. Pendulum fork **50** itself is permanently attached by anchoring arms **53** to bottom plates **60**. It is however, deflectable to a limited extent perpendicularly to the bottom plate by means of control pin **51**, due to its elasticity. This goal is accomplished by adjusting slide **40** which is displaceably mounted so that it can be moved by means of adjusting lever **41** along bottom plate **60**. A control cam **46**, the exact construction of which is shown in FIGS. **5–9**, it fits around control pin **51** of pendulum fork **50**. The shape of control cam **46** is such that arm **52** of pendulum fork **50** and hence pendulum axis **32**, when adjusting slide **40** is adjusted, are raised out of the position shown in FIG. **5** through those shown in FIGS. **5** and **6** and into that shown in FIGS. **8** and **9**, with pallet **20** with its arms **21**, **24** being brought increasingly into mesh with the teeth of escape wheel **13**, as is shown in detail in FIGS. **5***a* to **9***a*.

It is evident from FIGS. **3** and **4** that the lower area of pallet **20** and pendulum **30** as well as the connecting part **33** between them are mounted in a trough **61** whose edges **66**, located at the front and rear looking in the direction of travel, are raised above the surface of bottom plate **60**.

These trough edges **66** serve primarily to limit the oscillating motion of pallet **20** especially at its uppermost position in order to prevent jamming between arms **21** and **24** on the one hand and escape wheel **13** on the other, which could lead to complete jamming of the spring motor or at least a non-uniform influence on the rate at which the spring motor runs down.

The exact function of the braking device according to the invention is shown in FIGS. **5–9**.

FIG. **5** shows the braking device in its first shift position in which adjusting slide **40** has a locking nose **42** engaging a first notch **62** and bottom plate **60**. To further ensure that it remains in this position, the stop surface **45** which is located on the right-hand side of the adjusting slide abuts a projection **65** on the bottom plate.

The top of adjusting slide **40** is equipped with a number of stops **43***a* to **43***f* which limit the oscillation amplitude of pendulum weight **31**. For this purpose, a stop part with stops **34***a*, *b*, *c*, as well as **35***a* is provided below pendulum weight **31**, said stops being mounted on the underside of pendulum part **34**, and therefore connected to pendulum weight **31** and cooperating with above-mentioned stops **43***a* to *f* in the various shift and oscillation positions.

In the shift position according to FIG. **5**, pendulum weight **31** rests with its part **34** against stops **43***d*, **43***e*, and **43***g* in such fashion that the pendulum cannot move. In addition, pallet **20**, as indicated primarily in FIG. **5***a*, is lowered to the point where it cannot engage escape wheel **13** which rotates in the direction indicated by the arrow as the spring runs down.

Pallet **20**, pendulum **30**, and pendulum weight **31** are dimensioned and mounted in such fashion that pallet **20** is pivoted slightly counterclockwise relative to the horizontal position so that the arrangement shown in this embodiment ensures that the teeth of escape wheel **13** do not touch arms **21** and **24** of pallet **20**. Pallet **20** with pendulum **30** is held in this position since pendulum fork **50**, in which pendulum axis **32** is mounted, is held in the lowermost position by means of the right-hand part of control cam **46** and of control pin **51** which is located in the latter.

FIGS. **6** and **6***a* show the braking device in a second shift position.

To reach this shift position, adjusting slide **40** is slid toward the right out of the position shown in FIG. **5** until its locking nose **42** engages second notch **63** and its notch **44***b* engages projection **65**. By virtue of this displacement, pendulum fork **50**, which engages control cam **46** by its control pin **51**, is lifted out of the lower position into the middle position.

In this middle position, as FIG. **6***a* shows more clearly, pallet **20** engages escape wheel **13**. When escape wheel **13** rotates clockwise, one of its teeth moves along the inside of arm **21** and tilts the latter, bringing pendulum **30** with pendulum weight **31** into the position shown in FIGS. **7** and **7***a*.

As FIGS. **6** and **7** show, the oscillation amplitude of the pendulum is limited by the fact that on the one hand it strikes (by means of stop **85***a* on tongue **35**) stop **43***f* of adjusting slide **40** (see FIG. **6**) and on the other hand (with stop **34***a*) it strikes stop **43***b* of adjusting slide **40** (see FIG. **7**). In the position shown in FIGS. **7** and **7***a*, escape wheel **13** has one of its teeth **13***a* moving along the contact surface **25** of pallet **20** which slopes inward relative to pallet **20**. Since the tip of tooth **13***a* strikes contact surface **25** of pallet **20** at an acute angle, escape wheel **13** can swing pallet **20** away with less force.

The end position in which the braking device according to the invention exert its maximum braking action is shown in FIGS. **8** and **9**.

In order to reach this position, adjusting slide **40** must be slid all the way to the right until its locking nose **42** engages third notch **64** and its notch **44***a* engages projection **65**, locking the slide **40** in the end position.

By means of control cam **46** and control pin **41** cooperating therewith, pendulum weight **30** with pallet **20** and pendulum **31** is raised further in the manner described above, so that the depth of engagement of arms **21** and **24** in the teeth of escape wheel **13** is increased to its maximum.

At the same time, the arrangement of the stops on adjusting slide **40** and pendulum **30** is changed in such fashion that pendulum **30** reaches maximum oscillation amplitude with pendulum weight **31**. Thus, pendulum **30**, in its right-hand position shown in FIG. **8**, with the stop surface **35***a* at the front on tongue **35**, strikes stop **43***e* of the adjusting slide **40** and, in its left-hand position shown in FIG. **9**, strikes stop **43***a* of adjusting slide **40** with its stop **34***b*. As is shown clearly by the dot-dashed lines of symmetry Z of the pendulum, this increases the amplitude of the oscillations to the maximum extent, which necessarily leads to a slowing of the motion of the pendulum **30** and hence of the rotational speed of escape wheel **13** connected to spring gear **11**.

In order to avoid undesirable jamming of escape wheel **13** in this position, arm **21** is provided with a projecting nose **23**, which limits the depth of penetration in cooperation with the inner surface of arm **21**. If arm **21** were to penetrate further into the space between the teeth, it could result in a complete stoppage of escape wheel **13** or at least to non-uniform braking and hence to irregular running down of the spring motor.

In the left-hand oscillation position shown in FIG. **9**, in contrast to the position shown in FIGS. **7** and **7***a*, tooth **13***a* of escape wheel **13** strikes surface **26** of arm **24** which slopes outward, and at an obtuse angle. As a result, in this position the friction between pallet **20** and escape wheel **13** is increased relative to the friction of the arrangement shown in FIG. **7***a*, resulting in a further increase in the braking action, hence reducing the rate at which the motor runs down.

According to another construction of the invention, oscillating weight **31**, preferably made of metal, is releasably connected with pendulum **30**. This offers the opportunity to change the braking action by replacing the pendulum weight, so that the spring motor, otherwise unchanged, can be used to drive toy cars of different weights or of different designs. This is of great importance for efficient manufacture.

It is also significant that the braking device according to the invention can be installed with a minor change of the spring motor during manufacture for example, according to the disclosure in U.S. Pat. No. 4,053,029, and German Patent 24 61 625. In this spring motor, described and shown in these patents, it is merely necessary to replace the purely decorative stops which are located on spring gear **1a** by escape wheel **13** and to supplement this spring motor subsequently with the braking device according to the invention consisting of pallet **20**, pendulum **30**, adjusting slide **40**, and pendulum fork **50**, and only slight changes to the bottom plate **60** will be required.

In this way, the invention can be used with the known spring motor by simple and economical measures.

One advantageous side effect of the braking action according to the invention is that it creates a noise as the spring motor runs down which resembles the sound of a motor, increasing the attractiveness of the toy car for children.

I claim:

1. A spring motor comprising:

(a) a drive shaft, and

(b) means for braking said drive shaft comprising:

i. an escape wheel mounted on said drive shaft, said wheel having teeth,

ii. a pallet,

iii. means for mounting said pallet on a pendulum axis for oscillatory movement about said pendulum axis,

iv. means on said pallet comprising at least one arm for alternately engaging the teeth of said escape wheel,

v. a pendulum weight and a pendulum part connected to said pallet, and stops on said pendulum part located in staggered position in the direction of oscillation, and

vi. means for adjusting the oscillation amplitude of said pallet comprising stops thereon matching said stops on said pendulum part.

2. The spring motor of claim **1**, wherein said means for adjusting the oscillation amplitude includes an adjusting slide, means for enabling displacement of said slide transversely of said pendulum axis, said adjusting slide having a control cam, and means for engaging said cam to increase or decrease the oscillation amplitude when said adjusting slide is displaced comprising a pendulum fork having a control pin engaging said cam.

3. The spring motor of claim **2** wherein the adjusting slide has a locking nose, and further including a bottom plate for supporting the spring motor, said bottom plate having notches thereon positioned for engagement by said locking nose when said adjusting slide is displaced.

4. The spring motor of claim **2**, wherein the adjusting slide has at least one notch therein, and said bottom plate has at least one projection to engage said notch when said adjusting slide is displaced.

5. The spring motor of claim **3**, and means for adjusting the depth of engagement of said pallet arm relative to the escape wheel, and hence the braking action of the braking device.

6. The spring motor of claim **5**, further including means for supporting the escape wheel in a fixed position relative to the motor, and means for mounting the pallet for oscillation in the pendulum fork.

* * * * *