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Nielsen et al.

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[54] **WINDING MECHANISM HAVING PLATFORM FOR SUPPORTING SPRING MOTOR DRIVEN VEHICLE**

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[73] Assignee: **Ideal Toy Corporation**, Hollis, N.Y.

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Related U.S. Application Data

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[52] **U.S. Cl.** ..... **46/1 K**, 46/39, 46/206, 185/39, 185/DIG. 1

[51] **Int. Cl.** **A63h 33/00**, A63h 17/26

[58] **Field of Search** ..... 46/39, 202, 206, 46/1 K; 185/DIG. 1, 10, 39, 40, 41

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[57] **ABSTRACT**

A wind-up mechanism for a spring-driven toy vehicle includes a housing having a vehicle support platform and a drive clutch rotatably mounted therein for releasably engaging and winding a spring-driven toy vehicle positioned on the platform. The rotatable clutch is driven in a predetermined direction to wind-up the spring driven toy through a first gear rotatably mounted in the housing coaxially of the clutch and operatively connected thereto for transmitting rotational movement to the clutch. A gear segment rotatably mounted in the housing and operatively connected to the first gear is pivotally connected to a winding handle and held in a relatively fixed position with respect to the handle segment by a tension spring which is operatively connected therebetween. The tension spring means permits the handle to pivot with respect to the gear segment when rotation of the clutch in the predetermined winding direction is resisted with a predetermined force by the spring driven toy so that rotation of the gear segment by the handle is stopped to prevent overwinding of the toy vehicle.

18 Claims, 2 Drawing Figures

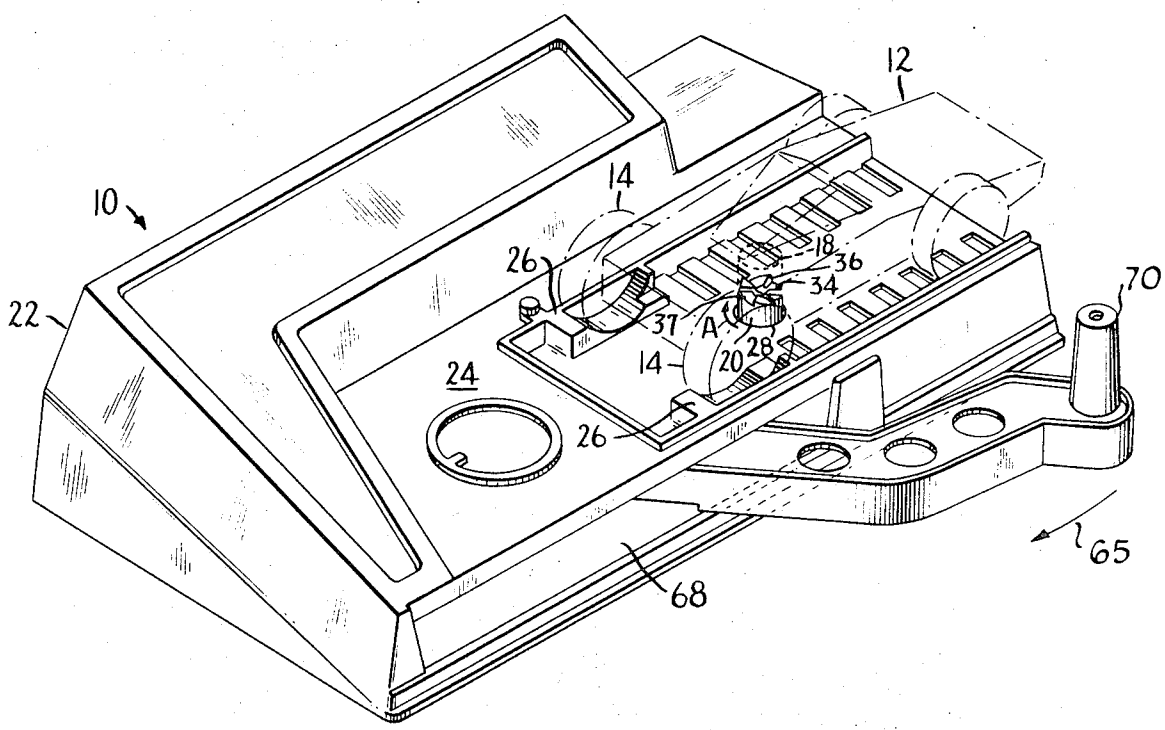

FIG. 1

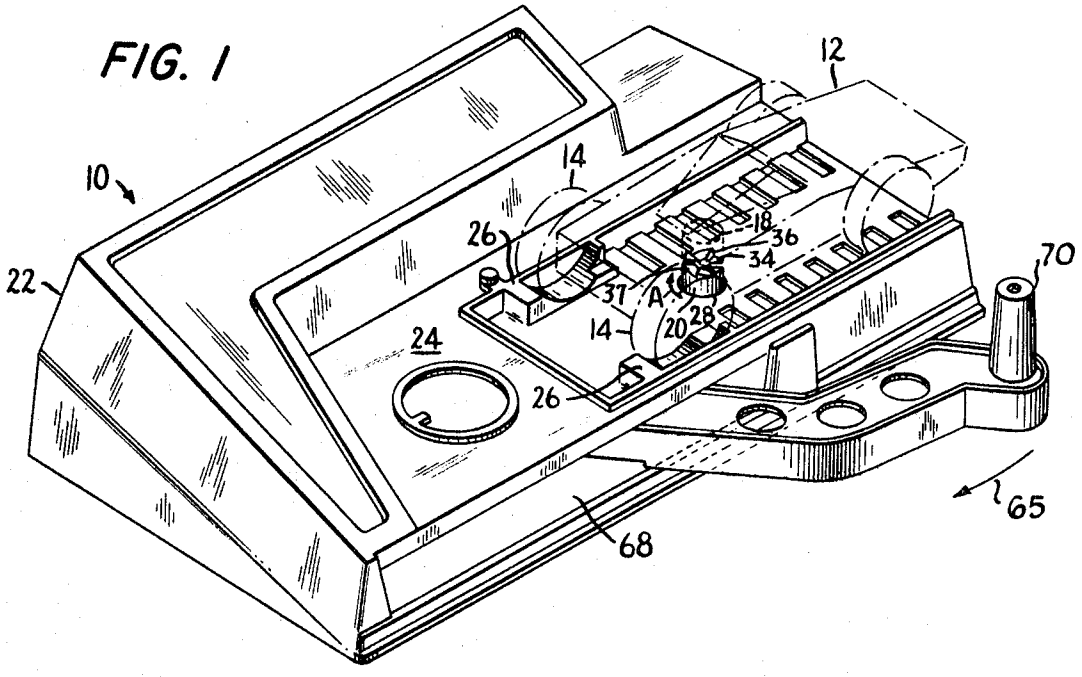
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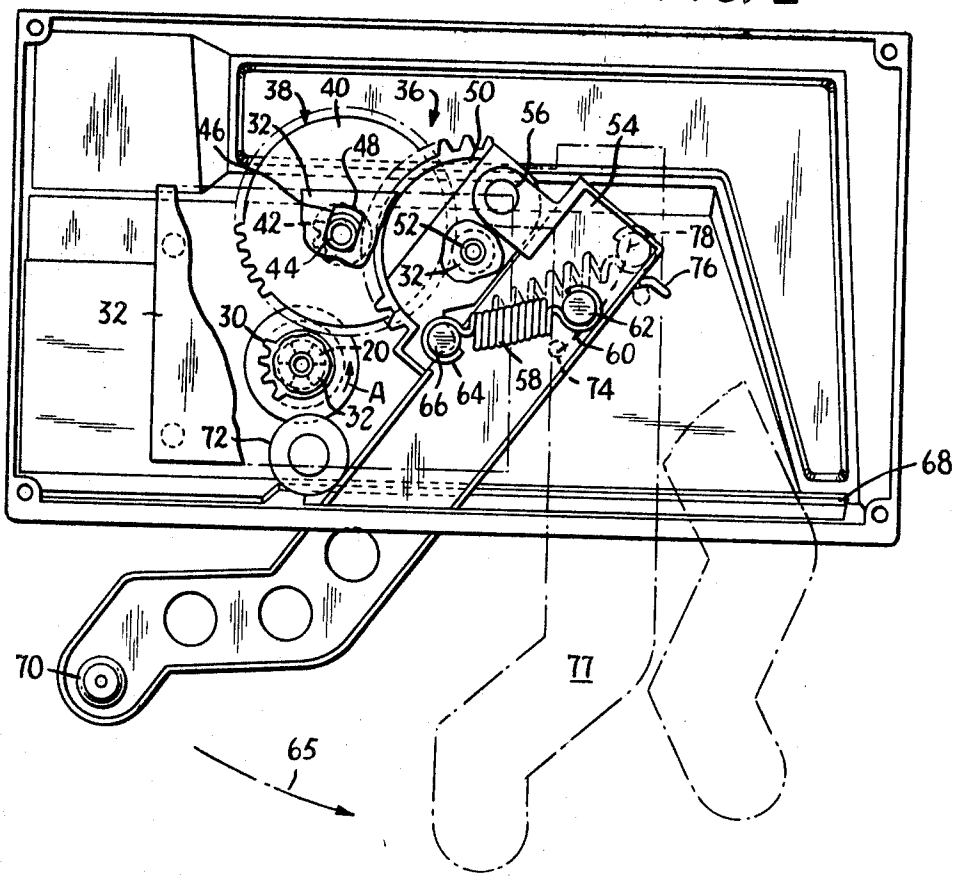
FIG. 2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WINDING MECHANISM HAVING PLATFORM FOR SUPPORTING SPRING MOTOR DRIVEN VEHICLE

This application is a continuation-in-part of our copending patent application Ser. No. 126,817, filed Mar. 22, 1971, the disclosure of which is incorporated herein by reference.

The present invention relates to a spring wind-up device for use with toys and in particular relates to a clutch mechanism for winding up spring-driven toy vehicles.

Spring drive mechanisms for toys, and in particular for toy vehicles, are well known and have been used for many years. Typically, the springs in such toys are wound up on an output drum which is rotated with a key that fits into an extension of the output drum. These prior art arrangements have been substantially improved upon by the spring wound toy and wind-up mechanism disclosed and claimed in our above-mentioned patent application.

The wind-up mechanism disclosed in our prior application has the advantageous feature that the wind-up mechanism provides for a quick engagement and release capability between the wind-up mechanism and the toy. This wind-up mechanism is particularly useful as a "pit stop," in connection with toy race vehicles or games, such as are more particularly disclosed in U.S. Pat. application Ser. No. 126,818, filed Mar. 22, 1971, the disclosure of which is also incorporated herein by reference, in which the spring-driven toy vehicles must have their springs quickly rewound during the course of a competitive race.

The present invention represents an improvement on the wind-up mechanism disclosed in our prior application which assures the prevention of overwinding the spring in the toy vehicle.

In accordance with one aspect of the present invention, the wind-up mechanism is utilized with a toy vehicle having a spring drive including a spring and a driven hub mounted in the toy for rotation about an axis and operatively connected to the spring to wind the spring upon rotation of the driven hub in a predetermined direction. The wind-up mechanism itself includes a housing having a driven hub rotatably mounted therein with both the drive and the driven hub having complementary teeth adapted to engage each other when the toy vehicle is placed on the housing. As a result, the rotation of the driven hub is transferred to the drive hub of the toy vehicle to wind-up the spring therein.

The housing of the wind-up mechanism includes a first gear rotatably mounted therein, coaxially of the driven hub, and operatively connected thereto for transmitting rotational movement to the driving hub. A rotatable swing gear is mounted in the housing for selective movement into and out of engagement with the first gear to selectively drive that gear and thus the hub in the desired predetermined direction. The swing gear is in turn, driven and controlled by a gear segment which is also rotatably mounted in the housing and pivotally connected to an operating handle which is utilized to rotate the gear segment.

A tension spring is operatively connected between the gear segment and the handle in order to hold the handle in a relatively fixed position with respect to the gear segment so that arcuate motion of the handle rotates the gear segment during the winding of the toy. This spring connection also permits the handle to pivot with respect to the gear segment when rotation of the driving hub and thus the gears in the wind-up mechanism is resisted with a predetermined force by the toy. As a result, continued arcuate motion of the handle no longer rotates the gear segment and overwinding of the spring in the toy is prevented.

The above and other features and advantages of the invention will be apparent in the following detailed description of an illustrative embodiment thereof which is to be read in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a wind-up mechanism constructed in accordance with the present invention, illustrating in phantom lines, a spring driven toy vehicle seated on the wind-up mechanism; and

FIG. 2 is a bottom view, with parts broken away, illustrating the drive train of the wind-up mechanism.

Referring now to the drawing in detail, and initially to FIG. 1 thereof, it is seen that a spring wind-up mechanism **10**, constructed in accordance with the present invention, is shown in conjunction with a spring wound toy vehicle **12** positioned thereon. The toy vehicle **12** may be constructed in accordance with the vehicles disclosed in the above-mentioned patent applications and includes a vehicle body which encloses a spring adapted to be wound on an output drum which is connected through a gear train to the drive axle of the vehicle's rear wheels **14**. The output drum of the spring mechanism within vehicle **12** is provided with a driven clutch hub **18** that extends axially downwardly from the output drum for engagement with a driving clutch hub **20** in the windup mechanism **10**.

In the present invention, wind-up mechanism **10** includes a housing **22** which may be of molded plastic construction and which is formed with a vehicle support platform **24** upon which toy vehicle **12** is positioned. Preferably, platform **12** is provided with a pair of wheel wells **26** which receive vehicle wheels **14** and locate the vehicle on platform **24** in a predetermined position such that its driven hub **18** will be engaged with driving hub **20** of the wind-up mechanism. Thus, during use of the wind-up mechanism, driven hub **18** and driving hub **20** are automatically aligned by the placement of the toy vehicle on the support platform **24**. This is particularly advantageous when the wind-up mechanism is used as a "pit stop" in the racing type game described in the above-mentioned patent applications since a substantial amount of time thus is saved in aligning hubs **18** and **20**.

Both driven clutch hub **18** and driving clutch hub **20** are provided with axially extending, coaxially distributed teeth **34** which are slanted circumferentially and raked at reentrant angles to form recesses **36**. When presented to each other, as seen in FIG. **1**, the teeth **34** are oriented in opposite angular directions so that upon engagement, the teeth of each clutch hub fit within the recesses of the opposite clutch hub for positive drive of the output drum of the spring mechanism contained within vehicle **12**. Preferably, hubs **18** and **20** are molded of a plastic material, such as high impact polystyrene and the recesses **36** are bounded by re-entrant surfaces **37**, preferably cut along radial lines by a cutting tool to form angles of about 53°.

Driving hub **20** is rotatably mounted in a recess **28** formed in platform **24** and is integrally formed with a coaxial pinion or first gear **30**, located below support platform **24**. Gear **30** includes a shaft (not shown)

which extends downwardly therefrom and is rotatably mounted in a support plate **32** secured in the underside of housing **22**. It is also noted that plate **32** is located at the lowermost portion of the housing and therefore encloses gear **30** between it and platform **24**. For clarity in illustrating the invention, plate **32** has been broken away in parts in FIG. **2**.

In order to rotate gear **30** and hub **20**, in order to wind the spring within vehicle **12**, a gear train **36**, including a swing gear **38**, is provided within housing **22**. Swing gear **38** comprises a pair of integrally molded gear members **40, 42**, with the larger gear **40** adapted to be positioned in meshing engagement with pinion gear **30**. Gears **40, 42** are integrally formed with a common shaft **44** which is rotatably mounted in an elongated slot **46** formed in base plate **32**. Slot **46** permits the gears to move from the position shown in FIG. **2**, i.e., wherein gear **40** is in meshing engagement with gear **30**, to a position at the opposite end of the slot wherein shaft **44** is in engagement with the edge **48** of the slot, so that gear **40** is out of engagement with gear **30**.

The positioning of shaft **44** in slot **46**, and thus the engagement or non-engagement of gear **40** with gear **30**, is controlled, as more fully described hereinafter, by a gear segment **50** which is rotatably mounted in housing **22** by a shaft or pin **52** secured in base **32**. Gear segment **50** forms an arcuate segment of approximately 180° and is pivotally connected at one side of its pivot **52** to a rigid elongated handle **54** by a pivot pin **56**. Handle **54** is also connected to gear segment **50** by a tension spring **58** which is secured at one end **60** on a pin **62** formed on the handle and is similarly secured at its opposite end **64** to a pin **66** on gear segment **50**. It is noted that the point of connection of spring **58** to gear **50** is on the side of its axis of rotation **52** which is opposite from the pivotal connection **56** between the gear segment and the handle. By this arrangement, handle **54** is normally maintained in a relatively fixed position with respect to gear segment **50** so that arcuate motion of the handle causes rotation of gear **50** about axis **52**.

To permit arcuate motion of the handle, that is, to permit the handle and gear segment **50** to pivot about pin **52**, housing **22** is provided with an elongated slot **68** through which handle **54** extends. Thus, the handle is readily accessible for winding a vehicle placed on platform **24**, and as a result, the platform need not be lifted to wind the vehicle. For convenience, a cylindrical handle **70** can be provided at the free end of handle **56** to facilitate movement of the latter in an arcuate path.

Slot **68** of of sufficient width to permit reciprocation of handle **56** between the solid line position and the dotted line position at the extreme right of FIG. **2**. The arcuate path between these two positions is the normal path of motion of the handle during wind-up of the toy vehicle. In one embodiment of the invention a resilient or cushioned annular bumper **72** may be mounted on platform **32** to define the extreme limit of movement of handle **56**, to the left, as seen in the drawing. This cushion will prevent engagement with the edge of the slot and damage to the handle in this direction.

The winding direction of rotation for hub **20** is illustrated in both FIGS. **1** and **2** by the arrow A. This direction is in the direction of the incline of the teeth **34** formed on hub **20** and assures engagement between the teeth of hub **20** with those of the driven hub **18**. In order to rotate hub **20** and thus gear **30** in the direction of arrow A, i.e., counterclockwise as seen in FIG. **2**, handle **54** is rotated from the solid line position illustrated in FIG. **2** towards the right, i.e., in a counterclockwise direction, indicated by arrow **65**. This motion of handle **54** causes gear segment **50** to rotate in a counterclockwise direction about its pivotal mounting **52**. The torque applied to gear **42** by the rotation of gear **40**, causes the gear to rotate in a clockwise direction and also causes its shaft **44** to move to its position in slot **46** as shown in FIG. **2**. This causes gear **40** to be placed in meshing engagement with gear **30** to drive that gear and thus hub **20** for winding of vehicle **12**.

Upon reaching the extreme end of its motion towards the right in FIG. **2**, handle **54** is returned to the left in order to repeat the winding motion. This return motion, from the extreme dotted line position shown in the right in FIG. **2** to the solid line position, causes gear **50** to rotate in a clockwise direction thereby rotating gears **40** and **42** in a counterclockwise direction. As a result, the torque now applied to gear **42** by gear **50** causes shaft **44** to move upwardly, towards edge **48** of slot **46**. Thus, gear **40** is moved out of engagement with gear **30** so that the latter gear and hub **20** are no longer driven during this portion of the motion of handle **54**. It is noted that slot **46** is formed to be substantially concentric with the gear **50** so that gear **42** and gear **50** are always maintained in engagement, irrespective of the position of shaft **44** in the slot.

In use, vehicle **12** is held with one hand against platform **24** and the frictional engagement between wheels **14** and platform **24** resists any tendency of the spring within vehicle **12** to unwind during movement of handle **54** from the right to the left in the drawing.

The above described procedure of oscillating handle **54** about pivot **52** is repeated until the spring in vehicle **12** is fully wound. At this point, as described in the above mentioned patent applications, an interference tooth and segment in a pair of gears in the gear train of the vehicle are engaged to limit further winding of the spring therein. As a result of the engagement of the interference tooth and segment and the gear train within vehicle **12**, a force is applied through the gear train of the vehicle to driven hub **18** which resists further winding of the spring. This force is transmitted through the gear train **36** in wind-up mechanism **10** to stall the gears therein and prevent further rotation thereof.

As a result of this stalling of gear train **36**, i.e., as a result of the resistance to movement of the gears in the gear train, further force applied to handle **54** to move the handle it its counterclockwise winding direction causes the handle to pivot with respect to gear **50** about its pivotal connection **56**. As a result of the pivotal motion of handle **54** with respect to gear **50**, no force is applied to the gear which would tend to rotate it and overcome the resistance force applied by the gear train in the vehicle. Thus, overtorquing or winding of the motor and gear train in the vehicle is avoided.

It is noted that spring **58** has a spring tension which is predetermined with respect to the resistance force applied by the spring drive mechanism of the vehicle, so that when that resistance force is reached, the tension force of spring **58** which normally holds the handle **54** in a relatively fixed position with respect to gear segment **50** is overcome and to permit the above described

pivotal motion of the handle with respect to the gear segment.

Normally, engagement of the interference tooth and segment in vehicle **12** can occur at any point during the motion of handle **54** towards the right in FIG. **2**, depending upon the relative position of the interference tooth and segment in the toy vehicle when the winding operation began. Should this resistive force occur at some point other than the solid line position of handle **54** illustrated in FIG. **2**, the tendency of the operator of the device would be to return the handle to the solid line position and again try to apply additional winding force to the handle. However, because of the resistive force applied by the vehicle, the gears **30**, **40** and **50** cannot be rotated and handle **54** will again pivot about axis **56** away from gear **50**. The amount of permitted pivotal motion is limited, however, by the provision of a cylindrical stop member **74** on the uppermost side of handle **54** and a cooperating stop surface **76** formed on the lower surface of platform **24**. These stops are positioned to engage each other when pivotal motion of handle **54** about pivot **56** begins at or near the solid line position of handle **54** so that the handle can move to an intermediate position **77** as shown in the drawing. This prevents overstretching of spring **58** which would either damage the spring or increase the force applied to gear segment **50**, forcing the gears in gear train **36** to rotate and thereby damaging the gear train in vehicle **12**.

It should be noted that during the normal operation of the wind-up mechanism, that is, when gear segment **50** is held against handle **54** by spring **58**, stop member **74** will bypass stop wall **76** because of its arcuate motion with handle **54**, along the path (indicated by a dotted line in the drawing). When the device is stalled, the axis of rotation of handle **54** changes from pivot **52** to pivot **56** so that the arcuate path of stop **74** changes and causes the stop to move into engagement with the surface **76**.

In operation of the "pit stop" winding mechanism **10** of the present invention, the wind-up mechanism remains flat on the floor and only vehicle **12** is moved, for the fastest possible winding operation. This is important in the racing type games described in the above-identified applications. Vehicle **12** is placed on platform **24** with its wheels **16** in wheel wells **26** so that its driven hub **18** is automatically placed in meshing engagement with the hub **20**. The handle **54** is then operated from the side of the wind-up mechanism to rotate hub **20** and thus hub **18**, in order to wind the spring mechanism within vehicle **12**. Because of the configuration of teeth **34**, on the respective hubs, the vehicle is retained against the platform **24** and the interaction between the re-entrant surfaces **37** of the hubs is effective to maintain engagement therebetween, especially during vigorous winding, when disengagement might otherwise be a problem.

Rotation of lever **54** in the direction of arrow **65** causes swing gear **40**, as described above, to move into engagement with the driven pinion or gear **30** and rotate driving hub **20**. A clockwise return movement of handle **54** is accompanied by disengaging movement of gear **40** whereby it is moved away from gear **30**. In this manner, repeated arcuate movements of handle **54** back and forth between the two extreme positions illustrated in the drawing provides a desired plurality of consecutive one-way rotations of driving hub **20** to wind toy vehicle **12**. After winding, manual lifting of the vehicle causes a reaction between re-entrant surfaces **37** to produce a simple and effortless angular and axial displacement of hubs **18** and **20**, with no special attention required.

After the spring in vehicle **12** has been wound to a point where the interference segments in its gear train have moved into contact with each other, further actuation of lever **56** results in movement of handle **54** with respect to gear segment **50** so that no further winding force is applied to the gears. In this manner, damage to the gears in the wind-up mechanism and to the spring drive mechanism of the vehicle is avoided.

Accordingly, it is seen that a wind-up mechanism constructed in accordance with the present invention has many advantages. The axially extending teeth in the clutch hubs engage and disengage with utmost speed and ease and without the need for any attention specifically directed thereto. The vertical toy retention feature is useful in precluding disengagement despite vigorous winding. Further, the gear trains in both the wind-up mechanism and the vehicle itself are protected against damage by overwinding by an accurate spring tensioned system provided in the wind-up mechanism which will be overcome when a predetermined resistance force is applied to the wind-up mechanism by the spring drive contained within the vehicle. The spring force can be accurately determined and therefore the tension spring **58** which controls the operation of the wind-up mechanism can be provided with the proper size and dimensions to produce the required force levels within the wind-up mechanism.

Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to that precise embodiment and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of this invention.

What is claimed is:

1. A wind-up mechanism for a spring-driven toy vehicle comprising, a housing having a vehicle supporting platform, drive clutch means rotatably mounted in said housing for releasably engaging and winding the spring-driven toy vehicle when said vehicle is located on said platform and means for rotating said clutch in a predetermined direction to wind up said spring-driven toy vehicle, said rotating means including a first gear rotatably mounted in said housing coaxially of said clutch and operatively connected thereto for transmitting rotational movement to the clutch, a gear segment rotatably mounted in said housing and operatively connected to said first gear, a winding handle pivotally connected to said gear segment, and tension spring means operatively connected between said gear segment and said handle for holding said handle in a relatively fixed position with respect to said gear segment during wind-up of said vehicle and for permitting said handle to pivot with respect to said gear segment when rotation of said clutch in said predetermined direction is resisted with a predetermined force by said spring-driven toy vehicle whereby arcuate movement of said handle normally rotates said gear segment to wind said toy vehicles and rotation of said gear segment by said handle is stopped to prevent overwinding of the spring-driven toy vehicle when said vehicle is fully wound.

2. The wind-up mechanism as defined in claim 1 including an intermediate swing gear operatively connecting said first gear and said gear segment, said housing having a slot and said swing gear being rotatably mounted in said slot for movement into and out of engagement with said first gear in response to the direction of rotation of said gear segment whereby said clutch is rotated only in said predetermined direction upon actuation of said handle.

3. The wind-up mechanism as defined in claim 2 wherein said housing has a second elongated slot through which said handle extends for movement in a limited arc.

4. The wind-up mechanism as defined in claim 3 wherein said handle and said housing have cooperating abutment members positioned in predetermined locations for limiting the pivotal movement of said handle with respect to said gear segment when rotation of said clutch in said predetermined direction is resisted with said predetermined force by said spring-driven toy vehicle.

5. The wind-up mechanism as defined in claim 3 wherein said clutch comprises a generally cylindrical hub member having a plurality of concentrically arranged teeth formed thereon about the axis of rotation of the hub for releasably engaging the spring driven toy vehicle during wind-up thereof.

6. The wind-up mechanism as defined in claim 5 wherein said toy vehicle includes a driven hub having teeth enaging said teeth of said clutch hub, said teeth on said hubs having a complementary configuration and being releasably vertically interlocking to retain the toy vehicle vertically on said platform in response to winding torque.

7. The wind-up mechanism as defined in claim 3 including cushioned stop means mounted in said housing adjacent one end of said elongated slot to limit the arcuate movement of said handle.

8. The wind-up mechanism as defined in claim 2 wherein said slot is substantially concentric with said gear segment whereby said swing gear always remains in meshed engagement with said gear segment.

9. The wind-up mechanism as defined in claim 2 including means on said platform for locating a toy vehicle placed thereon in a predetermined position with respect to said clutch.

10. The wind-up mechanism as defined in claim 2 wherein said tension spring means is connected to said gear segment on the opposite side of its axis of rotation from its pivotal connection to said handle.

11. A toy and wind-up mechanism therefore comprising, in combination, a toy having a spring drive including a spring, a driven hub mounted in the toy for rotation about an axis and operatively connected to said spring to wind the spring upon rotation of the driven hub in a first direction, said driven hub having a pluraity of concentrically arranged teeth extending therefrom about the axis of rotation of the driven hub; and a wind-up mechanism including a housing and a driving hub rotatably mounted in the housing, said driving hub having a plurality of concentrically arranged teeth extending therefrom about the axis of rotation of the driving hub, the teeth of each of said hubs being complementary to each other and located on the axial end of their respective hubs for axial engagement with the teeth of the other hub upon placing the toy on the housing with the driving and driven hubs axially aligned, and means for rotating said driving hub in a predetermined direction to wind said spring, including a first gear rotatably mounted in said housing coaxially of said driving hub and operatively connected thereto for transmitting rotational movement to said driving hub, a rotatable swing gear mounted in said housing for selective movement into and out of engagement with said first gear, a gear segment rotatably mounted on said housing and operatively engaged with said swing gear, a winding handle pivotally connected to said gear segment, and tension spring means operatively connected between said gear segment and said handle for holding said handle in a relatively fixed position with respect to the gear segment, whereby arcuate movement of said handle rotates said gear segment during winding of said toy, and for permitting said handle to pivot with respect to said gear segment when rotation of said driving hub in said predetermined direction is resisted with a predetermined force by said toy to prevent overwinding of said spring, said gear segment moving said swing gear into engagement with said first gear when said handle is moved from its first to its second position and moving said swing gear out of engagement with said first gear when said handle is returned from its second to its first position, whereby said driving hub is driven only in said predetermined direction during actuation of said handle.

12. The combination as defined in claim 11 wherein said housing has a slot formed therein, said swing gear being rotatably mounted in said slot for selective movement and said slot being substantially concentric with said gear segment whereby said swing gear always remains in meshed engagement with said gear segment.

13. The combination as defined in claim 12 wherein said housing has a second elongated slot through which said handle extends for movement in a limited arc.

14. The combination as defined in claim 13 wherein said handle and said housing have cooperating abutment members positioned in predetermined locations for limiting the pivotal movement of said handle with respect to said gear segment when rotation of said driving hub in said predetermined direction is resisted with said predetermined force by said spring-driven toy vehicle.

15. The combination as defined in claim 14 including cushioned stop means mounted in said housing adjacent one end of said elongated slot to limit the arcuate movement of said handle.

16. The combination as defined in claim 15 including means on said housing for locating said toy in a predetermined position wherein said driven and driving hubs are in meshed engagement.

17. The combination as defined in claim 16 wherein the teeth on each of said hubs slant in mutually complementary circumferential directions to form re-entrant capturing recesses for receiving the teeth of the other hub thereby to provide simultaneously both positive angular engagement between hubs and axial retention of the toy to the winding mechanism.

18. The combination as defined in claim 17 wherein said tension spring means is connected to said gear segment on the opposite side of its axis of rotation from its pivotal connection to said handle.

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