Dec. 15, 1970 E. A. NIELSEN 3,546,809

MULTIPLE SPEED TOY VEHICLE

Filed Feb. 26, 1969 2 Sheets-Sheet 2

FIG. 3.

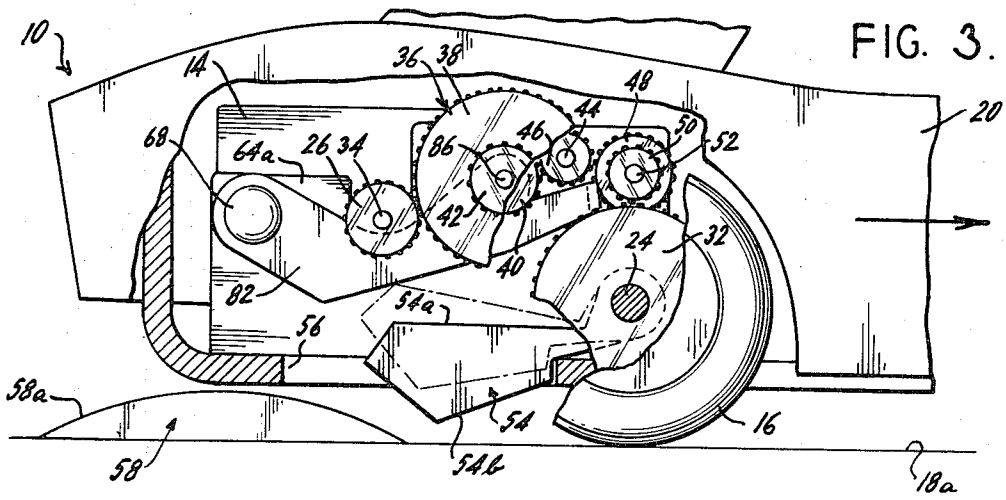


FIG. 4.

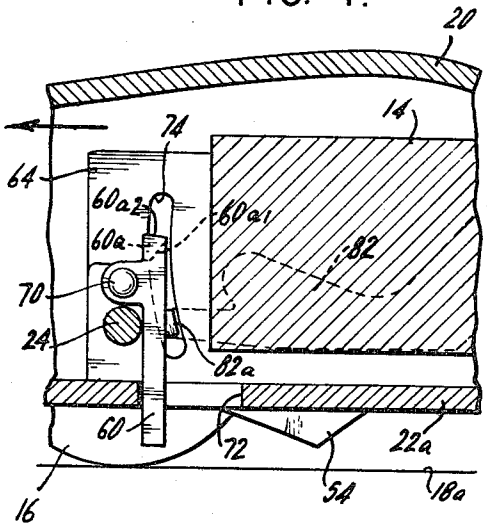


FIG. 5.

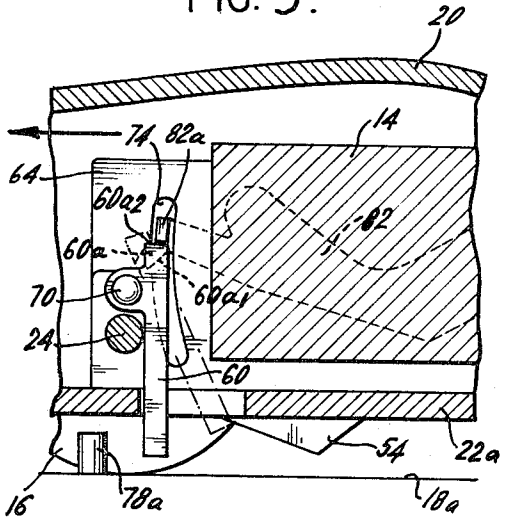
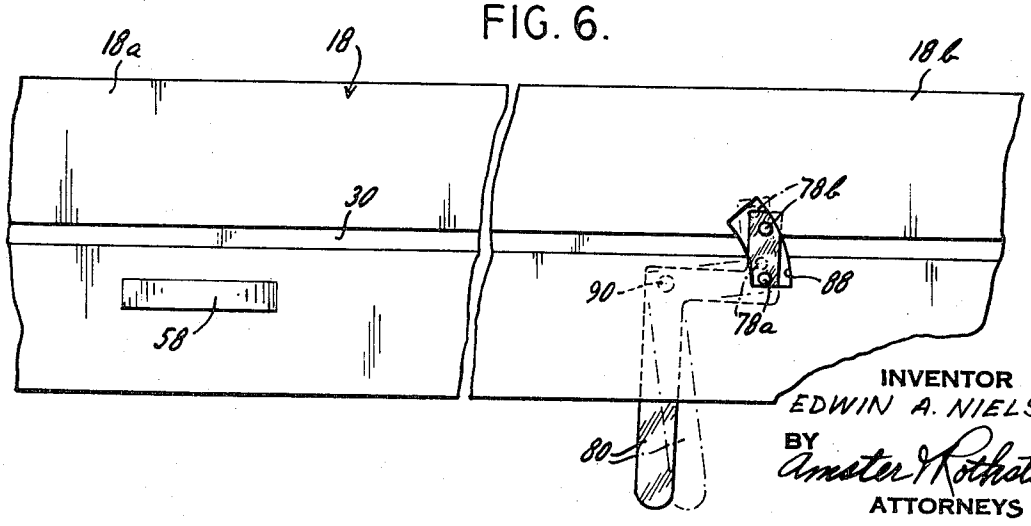


FIG. 6.



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MULTIPLE SPEED TOY VEHICLE

Filed Feb. 26, 1969 2 Sheets-Sheet 1

FIG. 1.

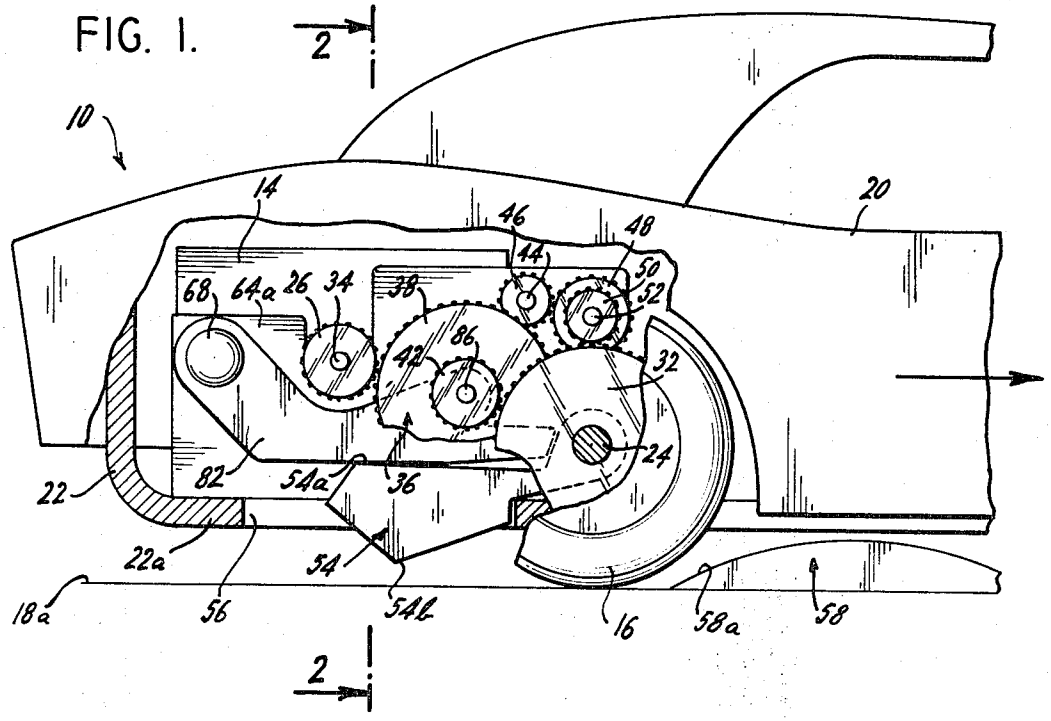
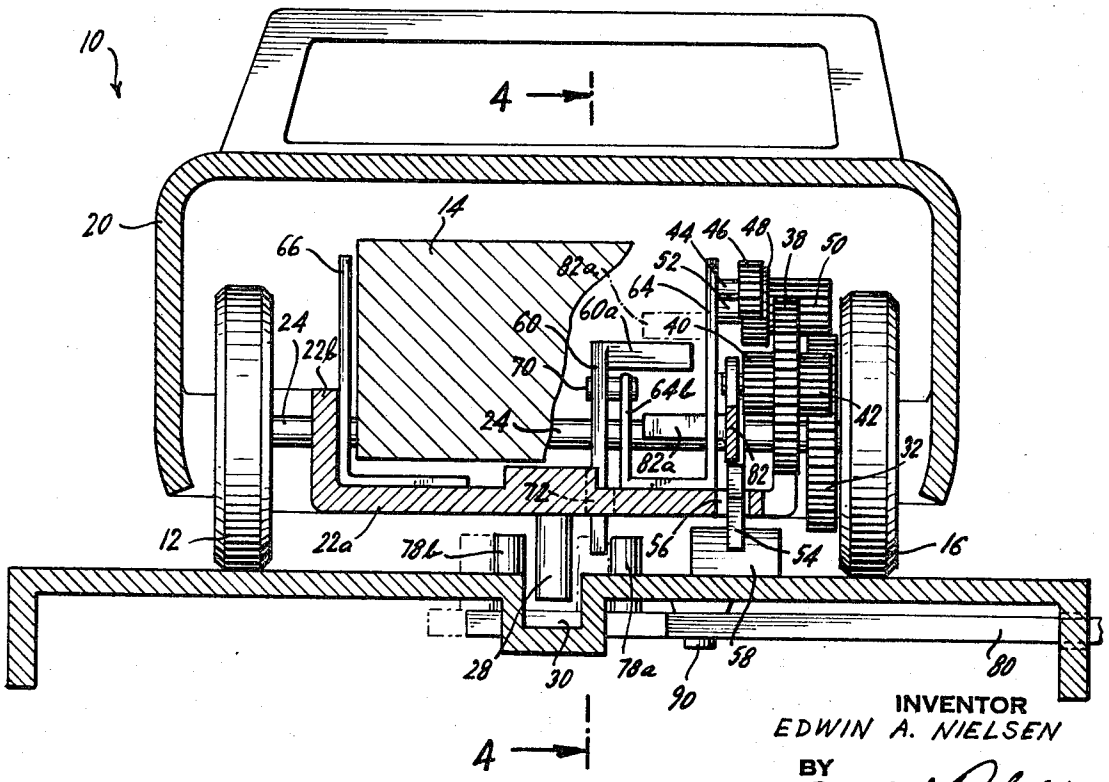


FIG. 2.



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MULTIPLE SPEED TOY VEHICLE

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U.S. Cl. 46—206 6 Claims

ABSTRACT OF THE DISCLOSURE

A multiple speed toy vehicle adapted to ride on a track is provided with a gear linkage including two alternate gear trains coupling a motor to a drive wheel so as to propel the vehicle at either of two different speeds. The vehicle is adapted to cooperate with two gear switching track sections, each for shifting the gear linkage from one state to the other.

This invention relates generally to children's play toys and more specifically to a multiple speed toy vehicle adapted to ride upon a toy track.

Toy vehicle systems including a powered toy vehicle and a toy track adapted to guide the vehicle along a prescribed course are well known in the prior art. To enhance the play value of such a toy vehicle-track combination, the present invention contemplates the use of speed shifting track sections and multiple speed toy vehicle adapted to shift speeds while passing over the speed shifting track sections.

The principal object of the present invention is thus to enhance the play value of a toy vehicle-track system; a further object is to provide a toy vehicle which is adapted to change speed as its passes over special track sections.

In the illustrative embodiment of the invention, the gear linkage system coupling the motor to the drive gear includes first and second alternate gear trains including a common adjustable idler gear movable between first and second operative positions and effective in the first position to impart rotational motion to the drive gear through the first gear train and effective in the second position to impart rotational motion to the drive gear through the second gear train. The vehicle includes levers adapted to cooperate with the speed switching track sections for moving the common adjustable idler gear between its first and second positions as the vehicle passes over the track sections, the idler gear thereafter remaining in its new position.

The above brief description as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of a presently preferred embodiment thereof, taken in conjunction with the appended drawings, wherein:

FIG. 1 is a side elevation view, shown partly cut away, of the rear portion of a toy vehicle constructed in accordance with the present invention, illustrating the power linkage system in its first operative position, and further showing a first section of the speed changing track;

FIG. 2 is a sectional view taken along line 2—2 in FIG. 1;

FIG. 3 is similar to FIG. 1 but shows the power linkage system in its second operative position after the vehicle has progressed further along the track;

FIG. 4 is a sectional view taken along line 4—4 in FIG. 2 and shows the pivotal geear support arm in its lower position;

FIG. 5 is similar to FIG. 4 but shows the pivotal gear support arm in its upper position; and

FIG. 6 is a plan view of the switching tracks.

Referring to the drawing, there is generally shown a toy vehicle **10** adapted to move along a toy track under power of a relatively constant speed motor **14** and to change speed as it passes over a switching track assembly, including specially adapted track sections **18***a* and **18***b*. The vehicle comprises a toy car body **20** secured to a toy car underframe **22** having a relatively flat bottom **22***a* and upturned lateral edges **22***b*. The underframe typically supports four wheels including rear drive wheels **12** and **16** and two forward wheels (not shown). Drive wheels **12** and **16** are rigidly secured to axle **24** which traverses the underframe **22** from side to side and is supported for rotation by holes in the upturned lateral edges **22***b*. The underframe also includes, at the rear thereof, a motor receiving cradle (best seen in FIG. 2) formed by mounting fixture **64** at one side of the underframe and electrical contact plate **66** at the other. Fixture **64** is secured to underframe **22** and includes a gear mounting plate **64***a* and an upright post **64***b*. The motor receiving cradle is adapted to receive an electric motor **14** and to make appropriate electrical contact between the motor and a pair of batteries (not shown) located in the car body. Specifically, contact plate **66** forms one electrical contact and mounting fixture **64** forms the other with motor **14** being designed to snap-fit between the gear mounting plate **64***a* and the contact plate **66** to assure proper mechanical support and electrical contact.

To permit the vehicle **10** to change speed without changing the motor circuit, underframe **22** includes a multiple speed power linkage system for delivering power from motor **14** to a wheel drive gear **32** which is rigidly secured to and concentric with wheel **16**. Since wheels **12** and **16** are rigidly fastened to axle **24**, rotation of gear **32** is effective to turn both rear wheels **12** and **16**.

The multiple speed power linkage system includes first and second alternate gear trains having different step-down ratios for driving gear **32** at different speeds. The first and second gear trains are alternately activated by a common idler gear assembly **36** which is mounted on pivotal gear support arm **82** by gear pin **86**, permitting the idler gear assembly to rotate freely. Pivotal gear support arm **82** is adapted to pivot about pin **68** fastened to gear mounting plate **64***a* between first and second operative positions wherein the gears of idler gear assembly **36** alternately cooperate in the first and second gear trains to deliver power from motor **14** to the wheel drive gear **32**. When idler gear assembly **36** is in the first operative position (shown in FIG. 1) it forms a part of the first gear train having a relatively low step-down ratio and serves to communicate power to the drive wheels **12** and **16** at a relatively high speed. When in the second operative position (shown in FIG. 3) the idler gear assembly forms a part of the second gear train having a relatively high step-

down ratio which imparts a low rotational speed to the drive gear **32**.

Both alternate gear trains include, at a first end thereof, a common motor driven or output gear **26** rigidly secured to drive shaft **34** of motor **14** and forming part of the motor assembly adapted to be snap-fit into the receiving cradle. Both alternate gear trains also include, at the second end thereof, wheel drive gear **32**.

In the position shown in FIG. 1, motor driven gear **26** having a radius R_{26} engages gear **38** having a radius R_{38} of idler gear assembly **36**, rotating the entire idler gear assembly about gear pin **86**. The outer gear **42** of the idler gear assembly **36** has a radius R_{42} and engages the wheel drive gear **32** which has a radius R_{32}. In order to drive the car forward, gear **26** rotates clockwise in FIG. 1, turning idler gear assembly **36** counter-clockwise and driving gear **32** clockwise. In accordance with well-known theory, the step-down ratio of this first gear train can be stated as follows:

$$\frac{R_{26}}{R_{38}} \times \frac{R_{42}}{R_{32}}$$

FIG. 3 shows idler gear assembly **36** in its upper or second operative position. Although gear **38** is raised, drive gear **26** is again maintained in contact with it. The inner gear **4** having a radius R_{40} of idler gear assembly **36** engages an intermediate gear **46** having a radius R_{46} mounted on gear mounting plate **64** by pin **44** which permits gear **46** to rotate freely. Gear **46** in turn engages a second intermediate gear **48** having a radius R_{48} and secured to gear support plate **64** by pin **52**. Gear **50** has a radius R_{50} and is rigidly secured to gear **48**, and is hence set in motion by the action of gear **46**. Gear **50** in turn engages the drive gear **32**. Gear **26** rotates clockwise in FIG. 3, turning idler gear assembly **36** counter-clockwise which turns gear **46** clockwise. Gear **46** turns gear **48** counter-clockwise and gear **50** turns gear **32** clockwise. The step-down ratio of the second gear train can be stated as follows:

$$\frac{\frac{R_{26}}{R_{38}} \times \frac{R_{42}}{R_{32}}}{\frac{R_{26}}{R_{38}} \times \frac{R_{40}}{R_{46}} \times \frac{R_{46}}{R_{48}} \times \frac{R_{50}}{R_{32}}}$$

Cancelling in this expression, we determine the ratio of the vehicle speed when driven by the first gear train to the vehicle speed when driven by the second gear train to be

$$\frac{R_{42}}{R_{40}} \times \frac{R_{48}}{R_{50}}$$

In the illustrative embodiment of the invention, $R_{42}=R_{40}$, and the ratio between speeds is established by the ratio of the radii of gears **48** and **50**. For the gear configuration shown, this ratio is approximately 2:1 indicating that the vehicle will travel twice as fast when arm **82** is in its lower operative position (FIG. 1) than when it is in its higher operative position (FIG. 3).

To enhance the play value of car **10**, the multiple speed power linkage system is adapted to cooperate with a speed shifting track assembly **18** comprising track sections **18***a* and **18***b* in FIG. 6 to change the car's speed as it rides over the track.

Specifically, pivotal gear support arm **82** and hence idler gear assembly **36** is shifted from one operative position to another, altering the gear train by which power is communicated from motor **14** to drive gear **32**, as the vehicle passes over switching track assembly **18**. To accomplish this shift, pivotal gear support arm **82** when in its first or lower position (shown in FIG. 1) rests against a second pivotal arm **54** which is pivoted about axle **24** and has an upper surface **54***a* and a lower surface **54***b* which protrudes downward through a slot **56** in underframe **22**. In this position pivotal arm **54** rests on the underframe **22** at the forward lip of slot **56** with pivotal gear support arm **82** resting on the upper surface **54***a* of the arm. When the car is running with arm **82** in the first

operative position, gear **26** applies a torque to drive gear **38** which forces arm **82** against the stop provided by arm **54**.

To shift the gear train, the gear switching track **18***a* includes an upward projecting ridge **58**, shown forward of wheel **16** in FIG. 1, having an upwardly ramped leading edge **58***a* positioned to engage surface **54***b* of pivotal arm **54** as the vehicle rides over the switching track and adapted to drive arm **54** upward against pivotal gear support arm **82**. Car **10** is maintained in a centered position on the track by depending pin **28** which rides in slot **30** of the track. The action of arm **54** against arm **82** raises arm **82** and hence common idler gear assembly **36** from its first operative position (FIG. 1) to its second operative position (FIG. 3). The motion of arm **82** and of idler gear assembly **36** between the first and second operative positions is in no way impeded by the interconnection of the various gears since the relative movement of mating gears between the engaged and disengaged positions occurs only in the plane of the mating gears. (In this sense, the "plane" of a gear is the region between the two parallel planes defined by the two faces of the gear.)

When arm **82** reaches its elevated or second operative position (FIG. 3) it becomes engaged by latching lever **60** including horizontal latching arm **60***a* in a manner to be described hereinafter and is thus retained in its second or latched position until released.

In FIG. 5, pivotal arm **82** is shown having been driven to its second or latched position by pivotal arm **54**. Arm **54** is shown in dashed line in FIG. 3 in approximately its uppermost position as vehicle **10** passes over ridge **58**. As will be seen in FIG. 3, arm **54** falls back to its lower position after it passes over the ridge.

Referring in detail to FIGS. 2, 4 and 5 wherein the interaction of lever **60** and pivotal arm **82** is shown, it will be seen that lever **60** is mounted on the inside post **64***b* of mounting fixture **64**, and is pivoted from pin **70**. Th lever projects down through slot **72** in underframe **22**. The lever pivots against a stop provided by axle **24** which passes through underframe **22** and is maintained in approximately vertical position when at rest. Gear mounting plate **64***a* includes an arcuate slot **74** which receives a first lateral projecting latching bar **82***a* extending inward from pivotal arm **82** at the forwardmost end thereof. Bar **82***a* is adapted to travel within arcuate cut-out **74** as arm **82** moves between its first and second operative positions. Bar **82***a* may comprise the forwardmost end of pivotal support arm **82** bent at a right angle with respect to the remainder of arm **82**. Lever **60** also includes a lateral projecting latching bar **60***a* which extends at a right angle to lever **60** over the inside post **64***b* of mounting fixture **64** toward pivotal arm **82** and bar **82***a*. Bar **60***a* includes a slanted rear face $60a_1$ and a top surface $60a_2$.

During the shift from position one (FIG. 1) to position two (FIG. 3), as arm **82** moves upward bar **82***a* travels upward in slot **74** engaging the slanted rear face $60a_1$ of arm **60***a* and rotating lever **60** away from the vertical position. When bar **82***a* passes above surface $60a_2$, lever **60** falls back to its normal vertical position. With latching lever **60** in the vertical or rest position, the upper face $60a_2$ of bar **60***a* obstructs lateral projecting bar **82***a* (and hence arm **82**), preventing it from falling back to its lower or first operative position (see FIG. 5). In this upper latched position (FIG. 5) the weight of pivotal arm **82** rests through lateral bar **82***a* on bar **60***a* driving latching lever **60** clockwise against axle **24**.

To shift arm **82** from its latched or second position (FIGS. 3 and 5) to its first or lower position (FIGS. 1 and 4), track **18***b* is provided with two upward projecting trip pins **78***a*, **78***b* either of which is movable into position to engage the lower end of lever **60** as vehicle **10** moves forward over switching track assembly **18***b*. It is to be understood that two trip pins are employed so that track **18***b* will function properly as vehicle **10**

travels in either direction. The engagement of lever **60** with one or the other trip pin **78***a* and **78***b* drives lever **60** counter-clockwise (in FIGS. 4 and 5) until bar **60***a* no longer obstructs bar **82***a* (the position shown in FIG. 5). When bar **60***a* releases bar **82***a*, support arm **82** falls to its lower position as shown in FIG. 1 under the urging of gravity and the force of gear **26** on gear **38**. By this action the first or high speed gear train (FIG. 1) becomes engaged moving the car ahead at the relatively high speed.

Section **18***b* of switching track assembly **18** is designed so that either of trip pins **78***a* or **78***b* may be moved into or out of position in the path of lever **60**. The switching track assembly can then be adjusted to return the drive system of car **10** to its first speed position or not as the operator chooses. To this end, track **18***b* includes a lever **80** pivotally mounted beneath track **18***b* by pin **90** and supporting trip pins **78** in a position beneath a slot **88** in track **18***b* so that the pins project up through the slot. Lever **80** projects beyond the edge of track **18***b* and may thus be manually rotated between two positions (shown in dotted and dot-dashed lines in FIG. 6), moving pins **78** in or out of the path of lever **60**. Thus if vehicle **10** approaches track **18***b* from the left in FIG. 6, lever **80** may be pivoted counter-clockwise by moving the projecting portion of lever **80** to the right in FIG. 6 putting pin **78***a* in the path of lever **60** as shown in dotted line in FIG. 2. If vehicle **10** were approaching from the right in FIG. 6, lever **80** would be moved to the left for pin **78***b* to engage lever **60**.

It is to be understood that the distance between the first section **18***a* of switching track assembly **18** having ridge **58** and the second section **18***b* having pins **78***a* and **78***b* may be any selected distance and that a single track section having both a ridge **54** and movable pins **78***a* and **78***b* may be employed in place of the separate track sections **18***a* and **18***b* shown in FIG. 6. While sections **18***a* and **18***b* are shown in FIG. 6 in close proximity to one another, they may be separated by intermediate track sections as desired.

Referring now to a typical sequence of operation of the shifting arrangement, as the rear portion of vehicle **10** passes over ridge **58** on track **18***a*, pivotal arm **54** is driven upwards bearing against pivotal gear support arm **82** and driving arm **82** into its uppermost position as shown in FIG. 3. Since arms **82** and **54** both pivot in a vertical plane, the weight of vehicle **10** cooperates with projection **58** to raise these arms without urging the car in a lateral direction. As pivotal arm **82** travels upward, lateral bar **82***a* travels upward in arcuate slot **74** engaging bar **60***a* and displacing lever **60** slightly in a counter-clockwise direction (see FIGS. 4 and 5) until bar **82***a* passes above bar **60***a*. At this point lever **60** rotates slightly clockwise under its own weight and assumes a vertical position against axle **24**, latching lateral bar **60***a* and hence pivotal arm **82** in its uppermost position. This position is the drive system's cocked position. FIG. 5 shows lever **60** in its vertical position with lateral bar **82***a* engaged above bar **60***a* and also shows (in dotted lines) lever **60** in its extreme position prior to its return to the vertical position. Whenever vehicle **10** rides over upward projecting ridge **58**, the gear drive system is shifted into this second or cocked position activating the second gear train and driving the vehicle at a low speed.

To return the gear train to its first position one of trip pins **78***a* and **78***b* is moved into the path of lever **60** which projects downward through the bottom of underframe **22**. Thus, as car **10** travels forward, the direction shown by the arrow in all figures, lever **60** engages the upward projecting pin **78***a* or **78***b* and is driven to its pivoted position shown in dotted lines in FIG. 5. Lateral bar **82***a* is thus no longer supported by arm **60***a* and pivotal arm **82** is free to fall to its lower position shown in FIG. 4. The vehicle thus resumes traveling at its high speed.

It is to be understood that the embodiments described above are merely examples of the application of the principles of the invention. Additional embodiments may be devised by those skilled in the art without departing from the spirit or scope of the present invention.

What is claimed is:

1. A multiple speed toy vehicle adapted to travel upon a track including at least one speed switching track section, said vehicle comprising a vehicle body, a plurality of wheels supporting said body for rolling movement, drive gear means for driving at least one of said wheels, a motor having an output gear, a gear linkage system coupling said motor output gear to said drive gear means, said gear linkage system having two alternate gear trains each including a plurality of gears wherein at least one of said plurality of gears is a common adjustable idler gear moveable between first and second operative positions in the plane of said idler gear and effective in said first operative position to impart rotational motion to said drive gear means through said first gear train and effective in said second operative position to impart rotational motion to said drive gear means through said second gear train, and means depending from said vehicle and responsive to engagement with said at least one speed switching track section for moving said common adjustable idler gear between said first and second operative positions as said vehicle passes over said switching track section.

2. A multiple speed toy vehicle in accordance with claim **1** wherein said common adjustable idler gear is urged toward said first operative position by said output gear and said depending means includes an arm projecting downward from said vehicle body and adapted to cooperate with an upstanding ridge on said switching track section to move said common adjustable idler gear to said second operative position, and further including latching means including a latching lever projecting downward from said vehicle and adapted to maintain said idler gear in said second operative position when moved thereto and to engage a trip pin on said speed switching track section to release said common adjustable idler gear from said second operative position.

3. A multiple speed toy vehicle in accordance with claim **2** wherein said at least one track section includes means for mounting said trip pin for movement between a first position in the path of said latching lever and a second position away from the path of said latching lever.

4. A multiple speed toy vehicle in accordance with claim **2** wherein said idler gear is mounted on a pivotal gear support arm having a latching bar extending transversely therefrom and wherein said lever includes a transversely extending latching arm, said latching arm and said latching bar being adapted to engage one another and to support said pivotal gear support arm in said second operative position and being further adapted to disengage and release said pivotal gear support arm when said lever strikes said trip pin.

5. A multiple speed toy vehicle adapted to travel on a toy track, said vehicle comprising a toy vehicle body, a toy vehicle underframe supported by wheels and supporting said body for rolling movement along said track, a motor mounted within said body for driving said vehicle along said track, a first gear train and a second gear train, said first and second gear trains alternately interconnecting said motor to at least one of said wheels, said first and second gear trains alternately including a common idler gear assembly movable toward and away from said track between first and second operative positions wherein said common idler gear is effective in said first position to participate in said first gear train and in said second position to participate in said second gear train, and shifting means extending from said vehicle and cooperating with projecting means on a switching track assembly for shifting said idler gear alternately toward

and away from said track between said first and second operative positions.

6. A multiple speed toy vehicle in accordance with claim 5 wherein said shifting means comprises a pivotal arm mounted for pivotal movement toward and away from said track, said arm protruding downwardly from said underframe and being adapted to engage a ridge on said switching track assembly, movement of said pivotal arm over said ridge and away from said track raising said common idler gear from said first operative position to said second operative position, and a latching lever retaining said idler gear in said second operative position and extending downwardly from said underframe to engage a trip pin on said switching track assembly, engagement of said lever with said trip pin relasing said common idler gear for movement toward said track into said first operative position.

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