

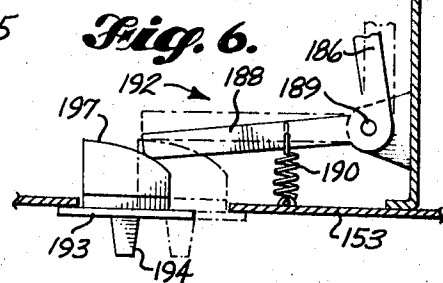
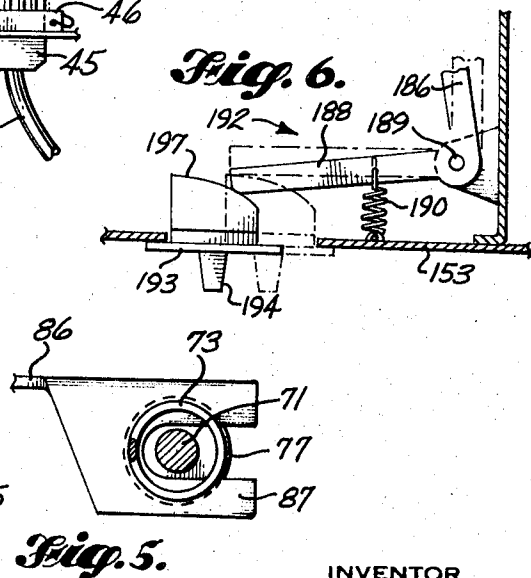
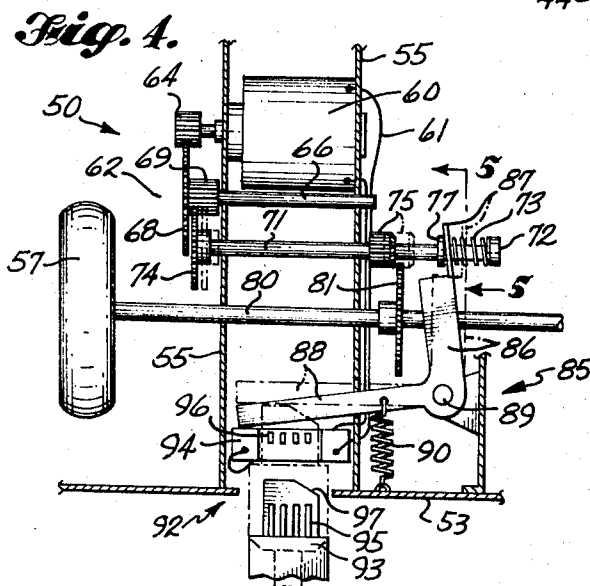
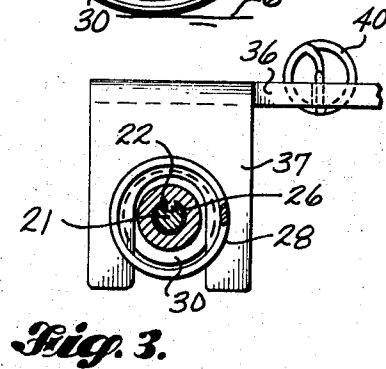
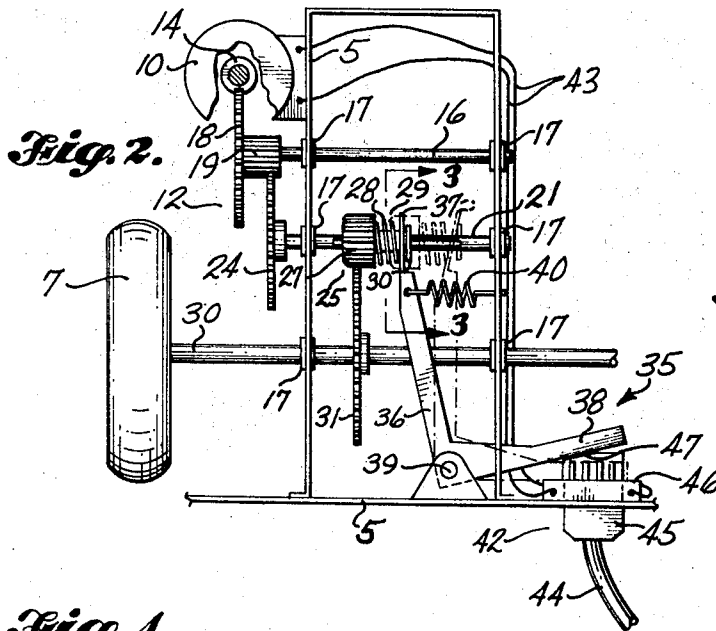
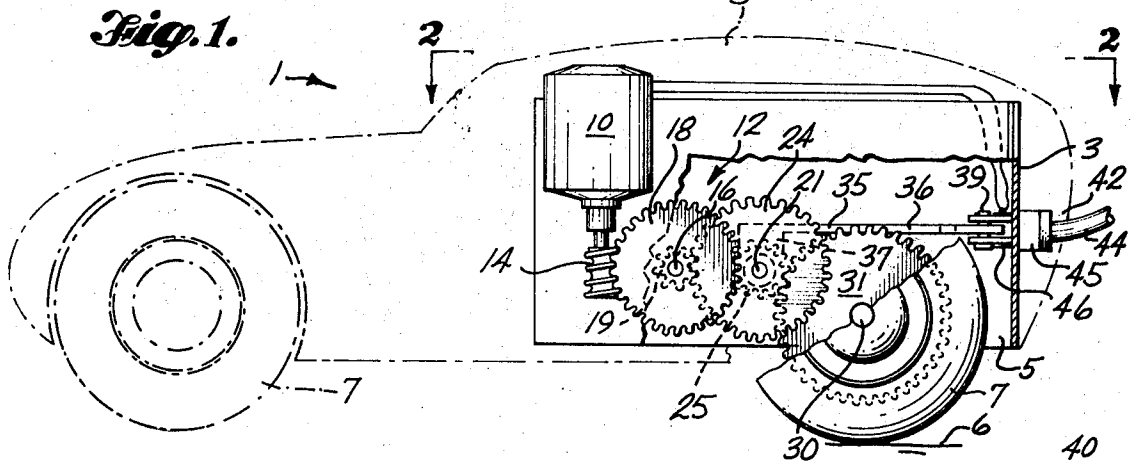
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3,538,640

POWER DRIVE DISCONNECT FOR TOY VEHICLES

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POWER DRIVE DISCONNECT FOR TOY VEHICLES

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11 Claims

ABSTRACT OF THE DISCLOSURE

A toy vehicle having two modes of operation over the ground, the first or "self-power" mode utilizes a windup spring or electric powered drive motor operatively connected through a gear transmission to drive ground engaging wheels to move the vehicle along the ground. The other mode is a "freewheel" mode wherein the power transmission disconnects the drive motor from the ground engaging wheels so that the vehicle can be pushed by the child in the freewheel mode without damaging the gears of the power transmission, or the operating mechanism of the power drive motor. In a preferred embodiment the disconnect mechanism is biased to the freewheel position and is actuated to the self-power mode by a switch, or in the case of remote controlled toys by a portion of the plug connector between the vehicle and the remote control unit.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a power transmission for toy vehicles and it relates more particularly to a disconnect mechanism which permits the vehicle to be operated alternately in a power driven or freewheeling mode.

Description of the prior art

Drive mechanisms for self-powered toy vehicles have made many advances in recent years. Their reliable operation and broad range of speeds have provided many hours of entertainment for their youthful owners. In the case of toy vehicles powered by electric motors it is generally characteristic of these toys that the motors are of relatively high speed, lightweight designs and therefore require a substantial gear reduction before the power from the drive motor can be applied to the ground engaging wheels of the vehicle. Due to the limitation on the price that can be reasonably charged for such toys, the quality and durability of the power transmission gears is of a nature that does not permit too rough of handling.

In the normal life of a self-powered electric toy vehicle it often occurs that by the time the initial set of batteries has become spent, the owner of the toy seeks to use it as a freewheeling toy awaiting the replacement of the batteries. It has been found, however, that pushing the toy along the ground, whereby the power is applied through the axle of the ground engaging wheels back through the transmission, often causes increased wear and ultimate destruction of the gears. This is particularly so in high gear ratio systems such as where a worm gear is used to transfer the power from the drive motor to the transmission gear reduction set. Thus the toy becomes useless, not only as an electric powered toy since the transmission will no longer transmit the power from the drive motor to the ground engaging wheels, but also in the freewheeling mode since the drag of the transmission and drive motor along with the possible mismeshing of the gears makes it difficult to rotate the ground engaging wheels at all. This, then, spells the end of the useful life of the relatively expensive toy.

A similar life cycle is experienced with toy vehicles

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having other than electric powered drive motors, since spring drive motors also generally utilize a power transmission gear reduction which does not operate very well when the power is transferred from the ground engaging means back through the transmission to the drive motor.

5 With this experience of a relatively short life for a relatively expensive toy, parents often develop sales resistance toward any type of self-powered vehicle. Thus it is seen that there is a definite need for an improvement in the design of a power transfer mechanism for toy vehicles, particularly to overcome the problems caused by attempted freewheeled operation of such vehicles. It is therefore the principal object of the instant invention to provide a generally improved power transmission mechanism for self-powered toy vehicles which includes a provision for disconnecting the ground engaging wheels from the power transmission and drive motor for freewheeled operation of the vehicle without damage to the power transmission and drive motor.

10 An additional object of the instant invention is to provide a gear disconnect mechanism for a toy vehicle transmission which provides a yielding member permitting easy and nondestructive meshing of the gears when the mode of operation is being changed from freewheeling to self-power.

15 Another object of the instant invention is to provide a self-powered toy vehicle utilizing a remote control cable plug as an actuator means for changing the mode of the power transmission of the vehicle from a freewheeling mode to a power driven mode.

20 A still further object of the instant invention is to provide a generally improved power transmission mechanism for self-powered toy vehicles including a disconnect assembly which in its normal position disengages the power transmission and drive means from the ground engaging wheels of the vehicle for freewheeled operation, and also provides means for easily actuating the disconnect mechanism for engaging the power transmission drive motor with at least one of the ground engaging wheels.

SUMMARY OF THE INVENTION

25 The present invention relates to an improved power transmission mechanism for toy vehicles which can be disconnected from the ground engaging wheels of the vehicle to permit the vehicle to be operated in a freewheeling mode without damaging or otherwise operating the power transmission and power drive motor. By utilizing the improved power transmission mechanism of the instant invention, it is possible to extend the useful life and thereby increase the buyer's acceptance of self-powered toy vehicles. It is also a feature of the instant invention to provide an easy and nondestructive means for actuating the disconnect assembly of the improved power transmission mechanism for toy vehicles so that they are reliable in operation, even when used by children of tender age.

30 According to the invention, these various objects are obtained by including in the power transmission a disconnect gear and linkage combination which permits the disconnect gear to be selectively engaged and disengaged to either operate in a power mode or permit operation of the ground engaging wheels free of any connection with the rest of the power transmission and drive motor. In one embodiment this is accomplished by mounting the disconnect gear on an axle having a keyway which permits the gear to move axially relative to its axle from a position in engagement with a gear fixed to the axle of a ground engaging wheel, or to become disengaged from this gear by being moved in the opposite direction along its axle through the operation of a disconnect linkage. In another embodiment the disconnect gear is fixed to its

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axle, and the whole axle is movable relative to the gear of the axle of the ground engaging wheel for selective engagement or disengagement with this gear through the action of a disconnect linkage which moves the disconnect gear's axle between the power mode and free-wheeling mode positions. In both embodiments a biasing means is interposed between the disconnect linkage and the disconnect gear to permit easy and nondestructive meshing of the disconnect gear when the linkage moves it from the freewheel to the power drive position.

These and other features and advantages of the invention will become more clearly apparent from the following detailed description thereof, which is to be read with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view with some parts removed for clarity of one embodiment of a self-powered toy vehicle utilizing the improved power transmission of the instant invention.

FIG. 2 is a plan view of the power transmission of the vehicle illustrated in FIG. 1 with some parts removed for clarity.

FIG. 3 is a partial side elevation view as seen through lines 3—3 of FIG. 2 illustrating one embodiment of the disconnect mechanism of the instant invention.

FIG. 4 is a top plan view of a second embodiment of the power transmission of the instant invention with some parts removed for clarity.

FIG. 5 is a partial side elevation view of the disconnect mechanism of the second embodiment as shown from lines 5—5 of FIG. 4; and

FIG. 6 is a top plan view of a third embodiment of the actuator assembly suitable for use in the improved power transmission of the instant invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For a more detailed understanding of the features of the first embodiment, reference is directed to FIGS. 1-3 wherein a wheeled vehicle is there generally designated 1 and illustrated as being a toy car such as a racing car. The car 1 may include a body 3 mounted on an appropriately shaped frame 5 which supports ground engaging wheels 7 in a position for running along the ground surface 6. A more specific description of the body frame and ground engaging wheels is unnecessary since their specific design is not a part of the instant invention and variations of suitable designs are well known by those skilled in the art.

Drive motor 10 is appropriately supported by frame 5 and through its output means, shown in the form of worm gear 14, is connected to a power transmission generally designated 12, which in turn, through various gears to provide intermediate speed reduction, is operatively connected through wheel gear 31 to the wheel axle 30 for powering ground engaging wheel 7. In more detail, the power transmission 12 may include a first intermediate axle 16 mounted and supported by frame 5 through suitable bearings 17 and including at one end a large gear 18 which is engaged by and rotated through the action of power output worm gear 14 of drive motor 10. Adjacent to and rotating with large gear 18 is a smaller gear 19 also supported by intermediate axle 16. The second intermediate axle 21 is also mounted for easy rotation in suitable bearings 17 supported by the frame 5, and includes at one end the large gear 24 which meshes with the smaller gear 19. Disconnect gear 25 is also supported by second intermediate axle 21 and rotates as a result of the rotation of large gear 24 through the connection provided by the axle keyway 22 formed in one surface of the second intermediate axle 21 and the key portion 26 of disconnect gear 25. Thus it is seen that the disconnect gear 25 is axially movable along keyway 22 of intermediate axle 21, while at the same time it is rotatable with intermediate axle 21. The gear portion 27 of disconnect 25

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is formed for meshing with wheel gear 31 which is fastened to and rotates with wheel axle 30 which supports at one ground engaging wheel 7. As illustrated in FIG. 2, torque from the drive motor 10 operates to turn its output worm gear 14 which, through meshing contact with large gear 18, rotates first intermediate axle 16 and along with it small gear 19. As the small gear 19 rotates, its meshing contact with large gear 24 causes the second intermediate axle 21 and the disconnect gear 25 to rotate, and in the position shown, the gear portion 27 of disconnect gear 25 meshes with the wheel gear 31 to rotate wheel axle 30 and with it ground engaging wheel 7.

The disconnect linkage 35, as shown in FIG. 2, includes crank lever 36 pivotally mounted by pivot 39 and having at one end a fork-shaped portion 37, and at the other an actuator portion 38. The disconnect linkage 35 is biased by means of spring 40 attached between the crank lever 36 and the frame 5 to normally rotate the crank lever 36 about pivot 39 to pull disconnect gear 25 out of engagement of its gear portion 27 with the wheel gear 31, as shown in dashed lines in FIG. 2, to permit the wheel axle and ground engaging wheel 7 to freely rotate without passing torque through the power transmission 12, or in turn to the drive motor 10. The full line position of actuator assembly 42, as shown in FIG. 2, causes the actuator end 38 of the crank lever 36 to rotate in a counterclockwise manner about pivot 39 to overcome the biasing force of spring 40 and thereby positions the disconnect gear 25 with gear portion 27 in meshing contact with wheel gear 31.

The actuator assembly may include an electrical control unit (not shown) which is held by the child for remote operation of the vehicle 1 and is connected to the vehicle 1 by means of control cable 44 terminating at a control plug 45 which is inserted into the plug female fitting 46 formed in the body 3 of the vehicle 1 to provide an electrical connection through wires 43 between the control unit and drive motor 10. The control plug 45 includes at its end an actuator surface 47 which, when the control plug 45 is inserted into female fitting 46, makes contact with and urges the actuator end 38 of crank lever 36 in a counterclockwise direction to connect and mesh disconnect gear 25 with wheel gear 31.

FIG. 3 shows the fork end 37 of crank lever 36 as it engages disconnect gear 25 through slot portion 29 to move disconnect gear 25 axially along second intermediate axle 21. To insure that gear portion 27 is not damaged as it is positioned by crank 36 to mesh with wheel gear 31, coil spring 28 is positioned within slot 29 formed in gear 25 between gear portion 27 and collar ring 30. Spring 28 biases gear portion 27 away from fork member 37 of crank 36, permitting some relative movement between gear portion 27 and fork member 37 to urge but not jam gear portions 27 into the teeth of gear 31 when crank 36 is in the power drive position.

Thus, it is seen that the disconnect mechanism of the power transmission 12 can be positioned through the action of the actuator assembly 42 and the disconnect linkage 35 in a power mode to connect the drive motor 10 through the power transmission 12 to the wheel axle 30 to rotate the ground engaging means 7 and thereby driving the vehicle 1. However, when the control plug 45 is pulled out of the fitting 46 spring 40 causes crank lever 36 to move in a clockwise manner about pivot 39 forcing disconnect gear 25 to move along second intermediate axle 21 far enough so that gear portion 27 no longer engages wheel gear 31. In this freewheeling mode it is possible for the ground engaging wheels 7 to rotate freely without damaging or otherwise operating power transmission 12.

To highlight the significance and to show the variety of means available for providing the results of the instant invention, attention is now directed to description of the second embodiment 50 as it is illustrated in FIGS. 4 and 5. The toy 50 includes a body 53 mounted upon and sup-

ported by a suitable frame 55 which also supports ground engaging wheel 57, drive motor 60, power transmission 62, disconnect linkage 85, and actuator assembly 92. In more detail, the drive motor 60 may be of an electric or spring motor type which includes an output means in the form of pinion gear 64 for transferring power through the power transmission 62 ultimately to the wheel 57.

The power transmission 62 may include first intermediate axle 66 having a large gear 68 meshing with pinion 64 and small gear 69 adjacent to and rotatable with large gear 68. A second intermediate axle 71 may include at one end an axle cap 72 which is biased by spring 73 away from fork end 87 of crank lever 86. Fork end 87 in its counterclockwise movement abuts disconnect band or axle collar 77 which is fixed to second intermediate axle 71.

A side elevation view of fork end 87 and disconnect collar 77 is shown in FIG. 5. At the other end of intermediate axle 71 is large gear 74 which meshes with small gear 69 to turn second intermediate axle 71. Between the disconnect band 77 and the large gear 74 is positioned a disconnect gear 75 which is fixed to second intermediate axle 71 and meshes with wheel gear 81, which in turn is connected through wheel axle 80 to ground engaging wheel 57.

To allow for the common situation in which the gear teeth of wheel gear 81 are not positioned exactly for meshing with the disconnect gear 75 at the same instant the crank 86 moves from the freewheel to power drive position, spring 73 permits relative movement between fork 87 and gear 75. This permits the power rotated gear 75 to be urged rather than jammed into meshing relationship with wheel gear 81.

In the solid line position the second intermediate axle 71 is bodily moved to the left, as shown in FIG. 4, by disconnect linkage 85 through the action of fork end 87 and disconnect band 77, so that disconnect gear 75 no longer meshes with wheel gear 81. Thus, the wheel 57 is free to rotate without any drag or damage caused to or by powered transmission 62.

To move the disconnect crank lever 86 between the power drive position shown in dashed lines to the freewheel position shown in the solid line, elements of the actuator assembly 92 come into play. Basically, the actuator assembly 92 includes an electrical control plug 93 inserted into fitting 94 and including at one end an actuator surface 97. When actuator assembly 92 is positioned in the actuation position as shown in dashed lines, actuator surface 97 is contacted by the actuator end 88 of a crank lever 86. In order that the disconnect gear 75 remains out of engagement with the wheel gear 81 when plug 93 is withdrawn from fitting 94 for the freewheeling mode, there is provided a biasing means in the form of spring 90 which is attached between the body 53 and the crank lever 86 so that the crank lever does not pivot about its pivot 89 to engage gear 75 with gear 81, unless and until actuated by means of the actuator assembly 92.

If desired it is possible to design the actuator means so that when the mode selection is changed from the freewheel to the self-power condition the disconnect gear is mechanically urged toward engagement with the wheel gear just before the drive motor is energized. With reference to FIG. 4 it is noted that the electrical connectors 95 on the plug 93 do not make contact with the electrical contact 96 in the fitting 94 to pass energizing current through wires 61 to drive motor 60 until after actuator surface 97 has caused lever 86 to urge disconnect gear 75 into engagement with wheel gear 81. This instant of delay permits the engagement of gears 75 and 81 before power is put to the transmission 62 by output means 64.

While in the two embodiments shown the disconnect gear has been biased away from the connection with the gear driving the ground engaging wheel, it is certainly

within the scope of this disclosure to have the biasing means actuating the disconnect lever to hold the gear into engagement until the actuator assembly moves the gear for disengaging the power transmission. This would be particularly suitable in the case of the third embodiment shown in FIG. 6 where a switch is used as the actuator means. It is also possible to use the actuator assembly 92 or crank 86 as part of the switch means for actuating and stopping the drive motor 60.

FIG. 6 illustrates a third embodiment actuator assembly 192 which does not involve the use of an electrical control connector such as plugs 45 and 92 shown in FIGS. 2 and 4. As shown the actuator assembly 192 includes a switch means 193 having a finger grip 194 and formed for easy sliding within vehicle 153 from the solid line freewheel position to the dashed lines power drive position, at which latter position it may also either make an electrical connection between batteries to energize an electric drive motor or release a spring to energize a spring motor. Switch 193 includes actuator surface 197 which as shown in the dashed lines position contacts actuator end 188 to cause crank lever 186 to pivot about pivot 189 overcoming the biasing force of spring 190.

It is, therefore, seen that there has been provided a generally improved power transmission means useful in toy vehicles for extending their life, while at the same time permitting the use of the toy in the freewheeling mode without damage and without the drag experienced by previously designed power transmission systems.

What is claimed is:

1. In a toy vehicle having a frame supporting a plurality of rotatable ground engaging means, drive motor means including power output means, an external control unit detachably connected to the vehicle by connector means and a control cable spanning between said connector means and said control unit, and power transmission means operatively connected between one of said ground engaging means and said power output means to transmit power from said motor means to said ground engaging means to move said vehicle relative to the ground; the improvement comprising: said transmission means including movable disconnect gear means having a power drive position to operatively connect one of said ground engaging means with said power output means and a freewheel position to operatively disconnect said ground engaging means from said power output means, and mode selection means having first means operatively connected to said disconnect gear means to move it to and from said power drive and freewheel positions, and other means operatively connected to said drive motor to energize it in said power drive position and to deenergize it in said freewheel position, said mode selection means being responsive to the interconnection between said vehicle and said connector means to move said disconnect gear means from said freewheel position to said power drive position and responsive to the detachment of said vehicle from said connector means to move said disconnect gear means from said power drive position to said free-wheel position.

2. The toy of claim 1 wherein:

said power output means is a worm gear.

3. The toy of claim 1 wherein:

said mode selection means includes actuator means and disconnect linkage means,

said actuator includes an actuator surface, and said linkage includes a lever crank pivotally connected to said frame and having one end operatively connected to said disconnect gear means and another end positioned in the path of said actuator surface.

4. The toy of claim 3 wherein:

said linkage lever is biased to hold said disconnect gear means in said freewheel position until said actuator surface moves said lever about its pivot to move said disconnect gear means to said power drive position.

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5. The toy of claim 1 wherein:
said drive motor is electrically powered.

6. The toy of claim 1 wherein:

said transmission includes intermediate and wheel
axles, said wheel axle includes a wheel gear and at
least one of said ground engaging means fixed to
said wheel axle for rotational movement therewith,
said intermediate axle includes a first gear, said dis-
connect gear, and collar means supported for ro-
tational movement with said intermediate axle,

said intermediate axle includes a first gear, said dis-
output means to rotate said intermediate axle re-
sponsive to the rotation of said power output means,
and

said mode selection means includes linkage means
operatively connected to said disconnect means and
said collar means to move said disconnect gear into
engagement with said wheel gear in said power drive
position and out of engagement with said wheel
gear in said freewheel position.

7. The toy of claim 6 including:

biasing means positioned between said linkage means
and said disconnect gear means to yieldably urge
engagement between said disconnect gear means and
said wheel gear means when said mode selection
means moves from said freewheel to said power
drive positions.

8. The toy of claim 6 wherein:

said intermediate axle includes spring means, a cap
means and is supported by said frame means and
axially movable relative to said frame means,

said cap means is fixed to said intermediate axle and
supports one end of said spring means,

said collar is fixed to said intermediate axle between
said cap means and said disconnect gear,

said linkage means includes one end inserted between
said collar means and other end of said spring means
to engage said collar and spring,

means to move said intermediate axle and said dis-
connect gear means axially between said freewheel
and power drive positions.

9. The toy of claim 1 wherein:

said other means operates in sequence with said first
means with said first means moving said disconnect

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gear into said power drive position just prior to
said other means energizing said motor means when
said mode changes from said freewheel to said
power drive position and said other means deenergiz-
ing said motor means just prior to said first means
moving said disconnect gear out of said power drive
position when said mode changes from said power
drive to said freewheel position.

10. A toy vehicle and power control device comprising
in combination: vehicle drive means including a motor
having a power output shaft, a ground engaging drive
member, and power transmission means including a first
control member associated therewith, said transmission
means being operative to connect said shaft to said drive
member when said control member is in a first position
and to disconnect said shaft from said drive member
when said control member is in a second position; motor
control means; and connector means coupled with said
control means and movable from a first to a second posi-
tion, said connector means when moved from its first to
its second position operating to couple said control means
with said motor and to place said control member in
its said first position.

11. The apparatus of claim 10 wherein said first con-
trol member is a lever spring-biased towards its said
second position, said motor is an electric motor, and
said connector means includes an electric plug having
contacts engageable with the control circuit of said motor
and a cam surface engageable with said lever when the
plug is connected to the vehicle.

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LOUIS G. MANCENE, Primary Examiner

R. F. CUTTING, Assistant Examiner

U.S. Cl. X.R.

46-210

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,538,640 Dated November 10, 1970

Inventor(s) William L. Hayes

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In claim 6, delete line 9 in its entirety, and insert in its place:

-- said first gear operatively connected to said power --

SIGNED AND
SEALED
MAR 2 1971

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER,
Commissioner of Patents