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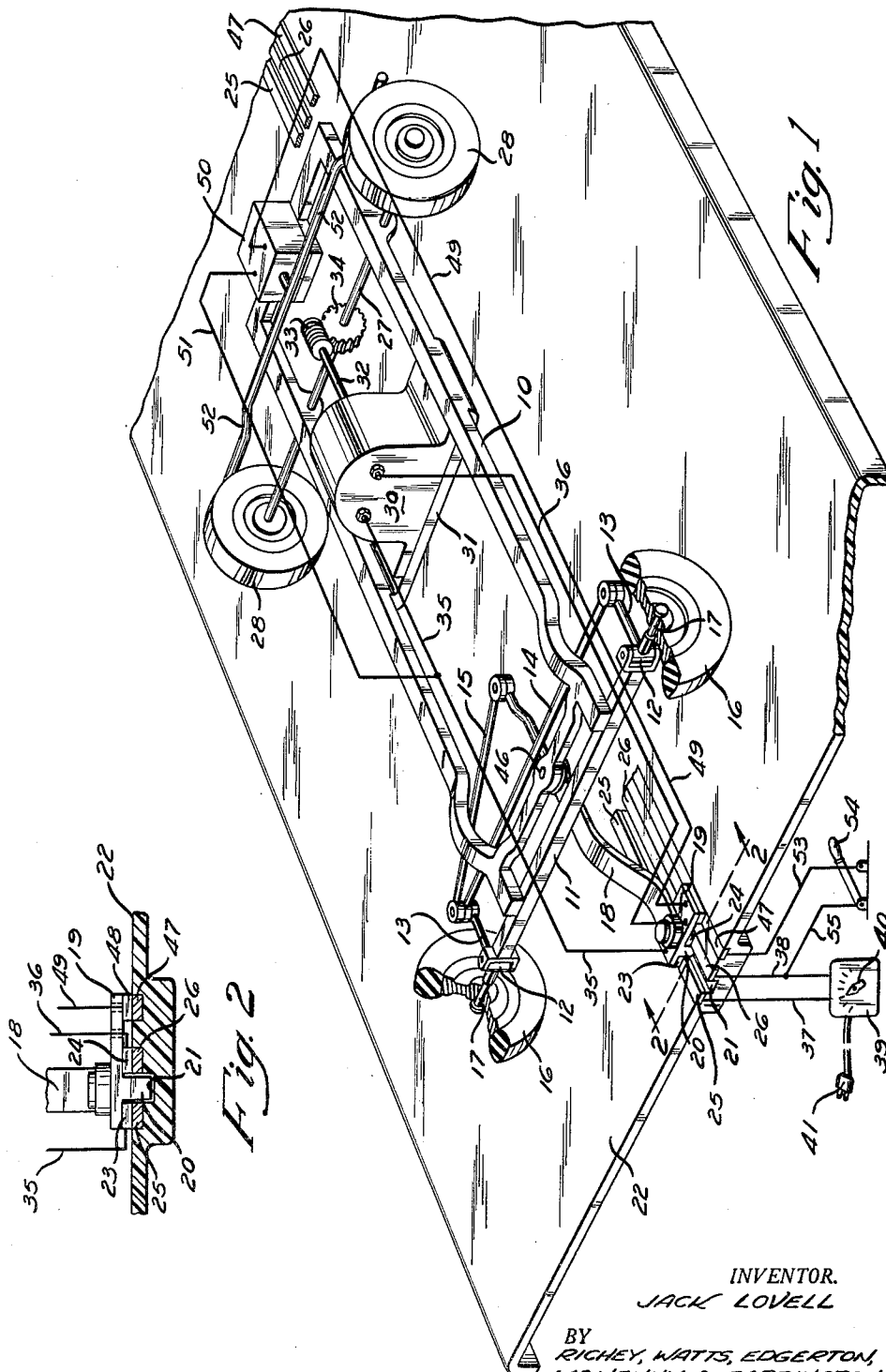
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TOY VEHICLE

Filed Sept. 27, 1957

2 Sheets-Sheet 1



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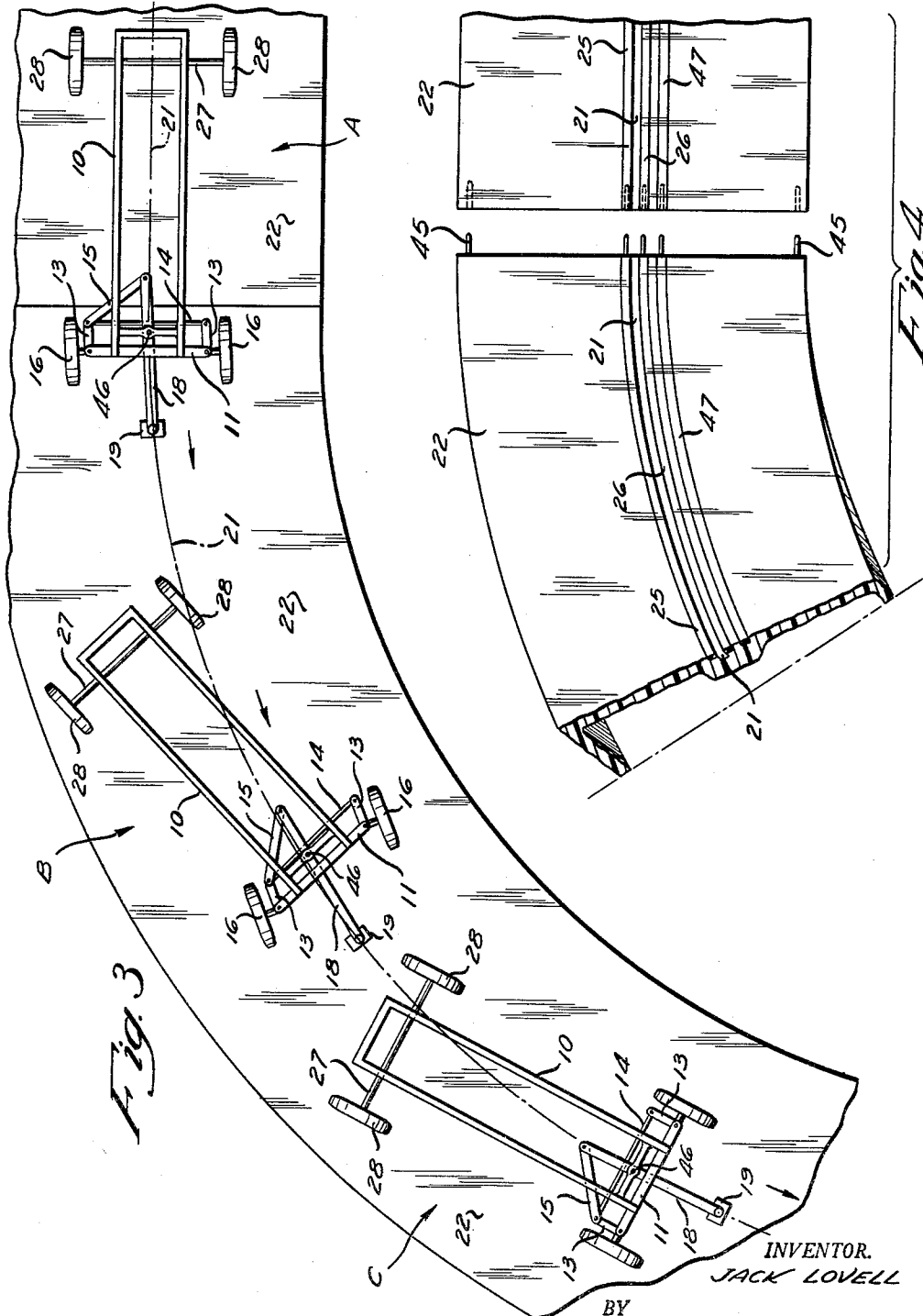
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1

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TOY VEHICLE
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This invention relates to a toy vehicle which is steered from the track upon which it runs.

The principal object of this invention is to provide a remotely powered and controlled toy vehicle which simulates the motions and steering of full scale vehicles of the type which are steered by human operators.

Another object of this invention is to support the vehicle by engagement of its wheels on the surface of a trackway and to drive and steer the vehicle by the friction between the wheels and the trackway, the guiding means serving only to turn the steering wheels and not to support the vehicle or confine its path of movement.

Further objects are to steer a self-propelled toy vehicle upon a trackway having curved portions in such a manner that the actual path of movement of the vehicle is determined only by the friction of the steering wheels upon the trackway acting against the inertia and driving force of the vehicle, the guiding means serving only to turn the wheels and not to restrain the vehicle frame, and to link the guiding means to the wheels in such a manner as to cause the wheels to turn automatically in the direction of a skid to control and limit the skidding, so as to simulate very realistically the skidding of a full sized vehicle properly handled, such as the "broadside" of a racing car around a turn.

Another object of this invention is to provide the aforementioned simulation of motion and steering by means which do not obstruct the travel of the wheels of the vehicle or restrict the sideways motion of the vehicle within the normal path of travel plus the area swept across by the vehicle when skidding, and to keep these means essentially flush or below the surface traveled on, to preserve the illusion of realism.

A further object of the invention is to provide a plurality of electrical circuits to the vehicle for the remote control of accessory devices such as lights, brakes, clutches, hoists, or control of a throttle on a gasoline motor powered vehicle.

A still further object of the invention is to provide a toy vehicle which can be used for training or demonstration of full scale vehicle operation since different arrangements of the steering linkage will produce both proper and improper corrective steering action required for maintaining control of the vehicle.

Other objects and advantages more or less ancillary to the foregoing, and the manner in which all the various objects are realized, will appear in the following description, which considered in connection with the accompanying drawings, sets forth the preferred embodiment of the invention.

In the drawings:

FIG. 1 is a view in perspective of the toy vehicle and guide plate embodied in the present invention, portions of the vehicle being broken away and shown in section in the interest of clarity;

FIG. 2 is a transverse sectional view through the guide plate, the section being taken on a plane indicated by the line 2-2 in FIG. 1;

FIG. 3 is a diagrammatic plan view showing three different positions of a vehicle rounding a curve on the guide plate;

FIG. 4 is a partial plan view of adjacent sections of the guide plate.

Referring first to FIG. 1, the toy vehicle comprises a

2

chassis 10 including a front axle 11, a pair of steering knuckles 12 pivoted on the yoked ends of the axle and having steering arms 13, a tie rod 14 pivotally connected to the steering arms 13, a drag link 15 pivoted to the steering arm on one side of the vehicle, wheels 16 on spindles 17 carried by the knuckles 12 and a steering lever 18 pivoted on a substantially vertical axis in the center of a frame cross member and pivotally connected to the inner end of the drag link 15. The steering lever preferably protrudes beyond the forward end of the vehicle and the free end thereof is pivotally mounted on a shoe 19 having a depending boss 20 thereon engaged in a groove or steering guideway 21 in a roadway plate 22. The shoe is further provided with brushes 23 and 24 which engage electrical contact rails 25 and 26 in the plate adjacent the groove.

The brushes 23 and 24 are electrically insulated from each other in any suitable manner. Preferably the shoe 19 is made of non-conducting plastic or similar material and the brushes 23 and 24 are cemented to its under-face. Similarly, the contact rails 25 and 26 are electrically insulated from each other. The contact rails may likewise be cemented to a base plate formed of plastic or other non-conducting material. The shoe 19 is lightly pressed downwardly to produce electrical contact between the brushes and the contact rails 25 and 26 without excessive friction, the boss 20 fitting loosely in the guiding groove 21 with adequate clearance to avoid binding in curved portions of the guideway. Preferably the forwardly projecting end of the steering lever 17 consists of a thin, resilient metal strip tensioned slightly to press the brushes against the contact rails without supporting any substantial part of the weight of the vehicle so that at least a major part of the weight of the vehicle is carried and supported by the wheels engaging the roadway plate 22.

The chassis frame 10 is further supported by a rear live axle 27 having wheels 28 affixed to its opposite ends. The front wheels 16 and the rear wheels 28 are provided with tires of rubber or the like to engage the roadway plate 22 frictionally.

A variable speed electric motor 30 is secured to a frame cross member 31 preferably located between the front and rear axles so that the weight of the motor is transmitted to both the front and the rear wheels. The armature shaft 32 of the motor is coupled to the live axle 27 by gearing which, in the illustrated embodiment, includes a worm 33 on the armature shaft 32 and a worm wheel 34 secured to the axle 27. The motor terminals are connected by conductors 35 and 36 to the brushes 23 and 24, respectively. The contact rails 25 and 26 are connected by wires 37 and 38 to an adjustable transformer 39 having a manual control 40 for regulating the voltage supplied to the motor 30. The transformer 39 is provided with a plug 41 for connection to the usual alternating current house circuit. Any other suitable source of power for the vehicle may be used if desired. It will be understood that any desired type of body, such as a shape simulating a racing car, truck or other full sized vehicle may be mounted upon the chassis frame 10.

The roadway plate 22 may be of any desired size and shape. Preferably it comprises straight and curved sections which may be detachably connected in any suitable manner as by pins 45 projecting from one end of each section and frictionally engageable in corresponding holes in an adjacent section, including metal pins carried by the contact rail sections 25 and 26 to provide electrical continuity. The complete roadway includes curved sections to provide a closed track which may be oval or any other suitable shape following the customary arrangement of toy electric train tracks. The trackway is made substantially wider than the vehicle itself having preferably about twice the width of the vehicle, and its up-

3

per surface upon which the vehicle rides is substantially flat. The vehicle is supported by its wheels resting upon the upper surface of the trackway and its path of travel is determined by the friction between the tires on the wheels and the surface of the trackway. The guiding groove 21 serves to move the steering lever 18 but, within the steering radius of the vehicle, does not confine or restrain the vehicle itself but merely turns the front wheels so that the path of travel of the vehicle is determined by its momentum and the friction of the wheels on the trackway. For this reason the upper surface of the trackway is substantially flat and free of projecting rails or flanges which might restrain or prevent lateral movement of the vehicle. While the upper surface is substantially flat, it may be and preferably is banked on curved sections of the trackway as illustrated in FIG. 4 so as to increase the maximum speed the vehicle can attain without over-turning.

Similarly the guiding groove 21 and the contact rails 25 and 26 are arranged to avoid restraint of free movement of the vehicle in any direction. In the illustrated form the contact rails 25 and 26 are embedded in and flush with the surface of the roadway plate 22 and the guide groove 21 is narrower than the tread surfaces of the rubber tires on the wheels. Thus, the rear wheels can cross over the guiding groove and the contact rails without being caught or restrained. The rails and the roadway plate need not be exactly flush since the tires on the wheels may pass over small irregularities without substantial restraint.

In the preferred embodiment, as illustrated, the length of the steering lever 18 between its pivotal connection to the vehicle frame at the point 46 and its pivotal connection to the drag link 15 is longer than the length of the steering arms 13 between the pivotal axes of the knuckles 12 and the pivotal connections to the tie rod 14. Thus a given angular movement of the steering lever 18 about its pivotal axis 46 produces a greater angular movement of the steering arms 13 about the pivotal axes of the knuckles 12. This arrangement permits better utilization of the surface of the trackway and better control of skidding or broadsiding.

When power is applied to the motor to drive the vehicle along a straight stretch of the roadway the vehicle quickly moves into and travels along a straight path with the longitudinal center line of the vehicle parallel with and directly above the straight guiding groove 21. When the boss 20 enters a curved portion of the guideway 21 as shown in the diagram A in FIG. 3 the steering lever 18 is pivoted in the direction of the curve of the guideway. Thus, as seen in FIG. 3 the steering lever 18 has been pivoted through a small angle to the left. This movement of the steering lever 18 turns the front wheels to the left through a slightly greater angle. When the speed of the vehicle is low and insufficient to cause skidding the vehicle continues to travel around the curve with its longitudinal center line moved radially inward from the curve of the guide groove 21 a small amount to compensate for the greater angle through which the front wheels are turned by a given angular turning of the steering lever 18.

When the vehicle is driven at a greater speed into and around a curved section of the roadway plate, the momentum of the vehicle tending to carry it along in a straight line and the lateral force produced by the inward turning of the front wheels as illustrated in the diagram A in FIG. 3 creates a couple which tends to skid the rear wheels of the vehicle radially outward on the roadway into the position illustrated in the diagram B in FIG. 3. In this action the chassis frame 10 of the vehicle rotates about the pivotal axis 46. Since the steering lever 18 cannot partake of this movement because the boss 20 is confined in the guiding groove 21 the outward skidding of the rear end of the vehicle produces relative rotation between the chassis frame 10 and the steering lever 18. When the vehicle itself tends to rotate to the left about

4

the axis 46 as seen in diagram B, the front wheels are turned in the same way as they would be turned by pivoting of the steering arm 18 to the right. In other words, the front wheels are turned to the right as seen in FIG. 3 toward the direction of the skid, and toward the direction in which momentum is attempting to carry the vehicle. In the preferred embodiment illustrated the front wheels are turned toward the direction of the skid through a slightly greater angle than the angle through which the vehicle itself has rotated about the pivotal axis 46 because the length of the steering lever 18 between the pivotal axis 46 and the drag link 15 exceeds the length of the steering arms 13.

This action by which the front wheels are turned toward the direction of the skid creates a new couple tending to swing the rear end of the vehicle inwardly or to the left as seen in FIG. 3, which stops the skidding action. As the vehicle moves in the direction in which the front wheels have been turned by the skidding action, as shown in the diagram B of FIG. 3, the entire vehicle, including the pivotal axis 46, moves radially outward on the curve. Because the steering lever 18 is pivoted to the chassis and to the shoe 19 on parallel vertical axes, the steering lever does not restrain or restrict this lateral movement. This outward movement of the pivotal axis 46 again produces relative pivotal movement between the chassis frame 10 and the steering lever 18, turning the front wheels toward the left. In normal operation the vehicle then finds a balanced position in which it "broad-sides" around the curve with both the front and the rear wheels pointing to the left of the true path of travel of the vehicle as seen in the diagram C in FIG. 3.

Before settling into a balanced position as illustrated in the diagram C of FIG. 3 the vehicle may hunt from one side to the other of the balanced position with the rear end first swinging outwardly on the curve and then inwardly. By controlling the speed of the vehicle with the adjustable transformer 39 the vehicle can be caused to travel around curves on the roadway plate in a controlled skid which, depending upon the speed, may vary from a slight amount of skidding in which the pivotal axis 46 may follow an arc of slightly less radius than the curve in the guiding groove 21 to a maximum amount of skidding in which the pivotal axis 46 may travel around a curve of substantially greater radius than the guiding groove 21. An excessive speed produces an uncontrollable skidding and overturns the vehicle.

The action of the vehicle in this respect faithfully reproduces the action of a full sized road vehicle in which skidding can only be corrected and controlled by turning the steering wheel in the direction of the skid and then finding the balanced position in which the vehicle moves around a curve with all four wheels rolling forward and simultaneously sliding laterally toward the outside of the curve, the center line of the vehicle being pointed radially inside of the true path of movement. Thus, the toy vehicle of the present invention not only provides entertainment and amusement by its ability to be operated to produce controlled skidding, but also is of educational value in teaching the correct principles that must be followed in controlling a road vehicle.

In the illustrated embodiment the roadway plate 22 is provided with a third rail 47 which may be used to supply an independent circuit on the vehicle for operating a headlight, horn, brake, or the like. As shown, this third rail 47 is engaged by a third brush 48 carried by the shoe 19 and connected by a wire 49 to a solenoid 50, the other side of the solenoid winding being connected by a wire 51 to the wire 35 connected to the brush 23. The core of the solenoid is connected to a bar 52 mounted to slide on the chassis frame 10 with its ends positioned to engage the tread surfaces of the tires on the rear wheels 28 to serve as a brake. The third contact rail 47 is connected by a wire 53 to a switch of any suitable type 54, the other side of the switch being connected

5

by a wire 55 to the wire 38 leading from the transformer 39. Thus closing the switch 54 applies the brake 52 to the rear wheels with a force determined by the adjustment of the transformer 39. Application of the brake when the vehicle is hunting or swinging back and forth seeking a balanced position around a curve can either increase or decrease the skidding. Thus, if the rear end of the vehicle is swinging outwardly as illustrated in diagram B of FIG. 3 application of the brake accelerates the outward swinging, whereas if it is swinging inwardly application of the brake may enable the vehicle to complete the curve without overturning.

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

What is claimed is:

1. An amusement device comprising a roadway having a guiding groove including a curved portion, a vehicle having rear wheels and dirigible front wheels resting upon said roadway and supporting the vehicle, said front wheels being pivoted to said vehicle to steer said vehicle, the upper surface of said roadway being substantially smooth and unobstructed through a lateral width substantially exceeding the width of said vehicle, a steering arm pivotally connected to said vehicle about a substantially vertical pivotal axis, linkage means connecting said steering arm and said front wheels operable to steer said front wheels under the influence of rotation of said steering arm about its pivot axis through an angle greater than the angle of rotation of said steering arm, means on the free end of said steering arm engaging in said guiding groove with freedom for relative pivotal movement between said steering arm and said guiding groove about a substantially vertical pivotal axis, power means connected to drive at least some of said wheels and impart forward motion to said vehicle at a speed producing skidding of all of said wheels when said vehicle follows said curved portion, said vehicle being substantially free of other guiding restraints whereby its path of travel on said roadway is determined by its inertia and the friction of said wheels on the roadway.

2. An amusement device comprising a base having a substantially smooth surfaced roadway, said base having a guiding groove open to the surface of said roadway including a curved portion, a toy vehicle having a frame, rear wheels journaled on said frame for rotation about a fixed axis, front wheels journaled on said frame and pivoted about steering axes to steer said vehicle, a steering linkage connected to said front wheels operable to steer said front wheels by turning them about their steering axes relative to said frame, all of said wheels frictionally engaging said roadway whereby the path of movement of said toy vehicle is determined by the frictional engagement of said wheels and the inertia of said vehicle, said wheels having a tread surface engaging said roadway wider than said groove so that said wheels can cross said groove without being caught or substantially restrained, a steering arm pivoted on said frame extending forward of said front wheels, a depending boss on said steering arm forward of said front wheels projecting into said groove and being laterally restrained by engagement with the walls thereof, means connecting said steering arm and said linkage operable in response to rotation of said steering arm relative to said frame to steer said front wheels in the same direction and through a larger angle than the angle of rotation of said steering arm relative to said frame, drive means mounted on said frame connected to rotate at least some of said wheels and impart forward motion to said vehicle, said drive means providing sufficient power to produce vehicle speed

6

resulting in skidding when said vehicle turns to follow said curved portion of said groove, excessive skidding of said rearward wheels causing said steering arm to rotate relative to said frame and steer said front wheels in the direction of the skid of said rear wheels until an equilibrium condition is reached wherein all wheels are skidding relative to said roadway.

3. An amusement device comprising a base having a substantially smooth surfaced roadway, said base having a guiding groove open to the surface of said roadway including a curved portion, a toy vehicle having a frame, rear wheels journaled on said frame for rotation about a fixed axis, front wheels journaled on said frame, a steering linkage connected to said front wheels operable to maintain them substantially parallel to each other and steer said front wheels by turning them relative to said frame, all of said wheels frictionally engaging said roadway whereby the path of movement of said toy vehicle is determined by the frictional engagement of said wheels and the inertia of said vehicle, said wheels having a tread surface engaging said roadway wider than said groove so that said wheels can cross said groove without being caught or substantially restrained, a steering arm pivoted on said frame extending forward of said front wheels, a depending boss on said steering arm forward of said front wheels projecting into said groove and being laterally restrained by engagement with the walls thereof, means connecting said steering arm and said linkage operable in response to rotation of said steering arm relative to said frame to steer said front wheels in the same direction and through a larger angle than the angle of rotation of said steering arm relative to said frame, drive means mounted on said frame connected to rotate said rear wheels and impart forward motion to said vehicle, said drive means providing sufficient power to produce vehicle speed resulting in skidding when said vehicle turns to follow said curved portion of said groove, excessive skidding of said rearward wheels causing said steering arm to rotate relative to said frame and steer said front wheels in the direction of the skid of said rear wheels until an equilibrium condition is reached wherein all wheels are skidding relative to said roadway.

4. An amusement device comprising a base having a substantially smooth surfaced roadway, said base having a guiding groove open to the surface of said roadway including a curved portion, a toy vehicle having a frame, rear wheels journaled on said frame for rotation about a fixed axis, front wheels journaled on said frame, a steering linkage connected to said front wheels operable to steer said front wheels by turning them relative to said frame, all of said wheels frictionally engaging said roadway whereby the path of movement of said toy vehicle is determined by the frictional engagement of said wheels and the inertia of said vehicle, said wheels having a tread surface engaging said roadway wider than said groove so that said wheels can cross said groove without being caught or substantially restrained, a steering arm pivoted on said frame extending forward of said front wheels, a depending boss on said steering arm forward of said front wheels projecting into said groove and being laterally restrained by engagement with the walls thereof, a connection between said steering arm and said linkage operable in response to rotation of said steering arm relative to said frame to steer said front wheels in the same direction and through a larger angle than the angle of rotation of said steering arm relative to said frame, an electric motor mounted on said frame connected to rotate at least some of said wheels and impart forward motion to said vehicle, electrical conductors in said base connected to supply power to said motor and control its operation, said motor providing sufficient power to produce vehicle speed resulting in skidding when said vehicle turns to follow said curved portion of said groove, excessive skidding of said rearward wheels causing said steering arm to rotate relative to said frame and steer

said front wheels in the direction of the skid of said rear wheels until an equilibrium condition is reached wherein all wheels are skidding relative to said roadway.

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