Nov. 23, 1971 H. J. MORRISON ET AL 3,621,607

SELF-PROPELLED TOY VEHICLE

Filed Dec. 15, 1969 2 Sheets-Sheet 1

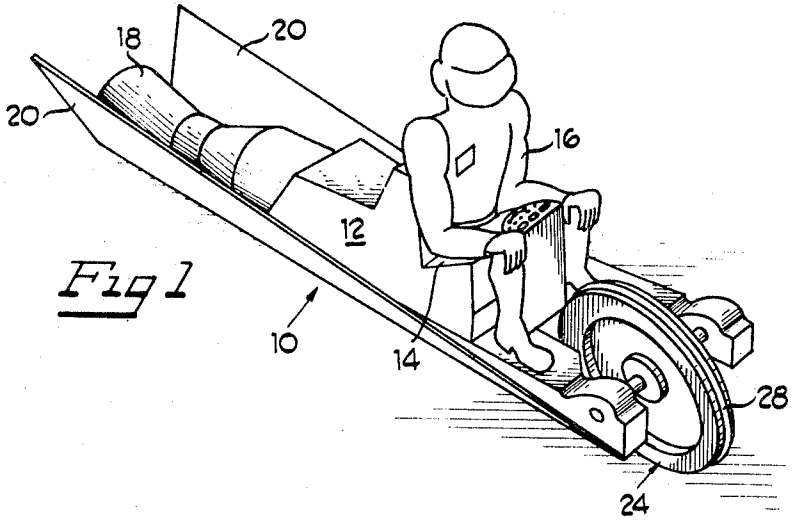

Fig 1

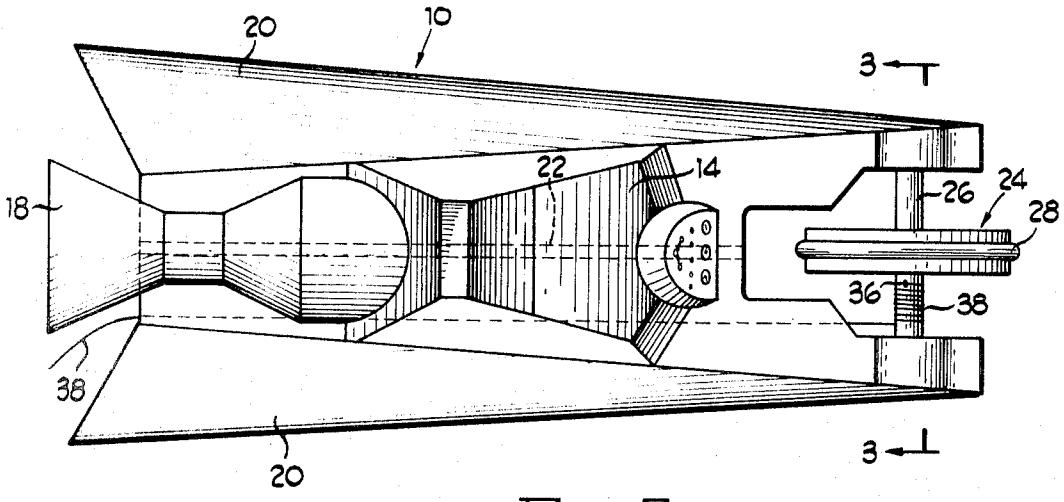

Fig 2

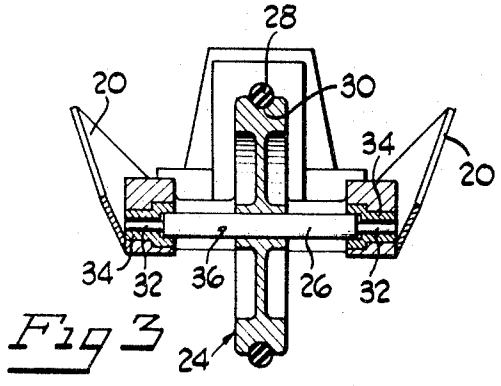

Fig 3

INVENTORS
HOWARD J. MORRISON
MARVIN I. GLASS

BY James D. Coffee
ATTORNEY

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SELF-PROPELLED TOY VEHICLE

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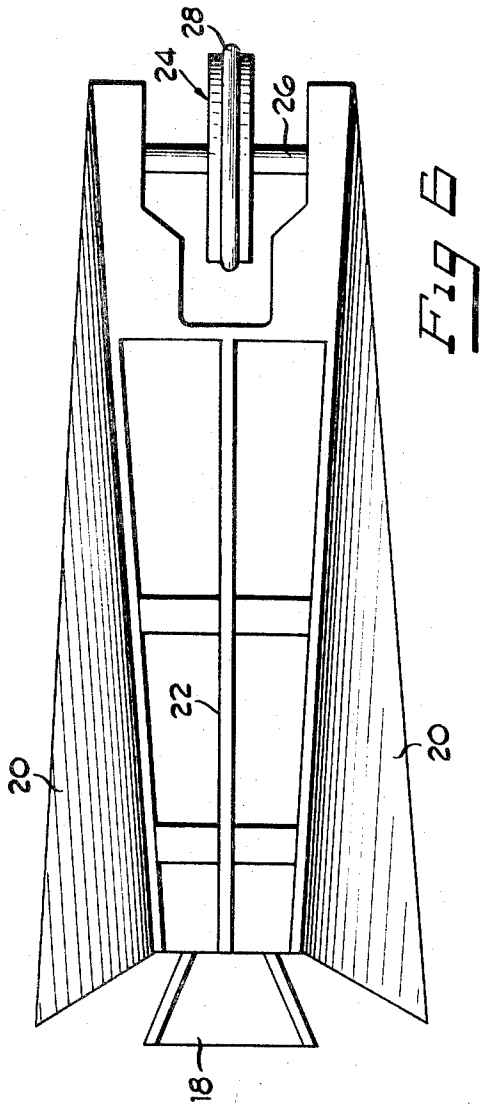

Fig 6

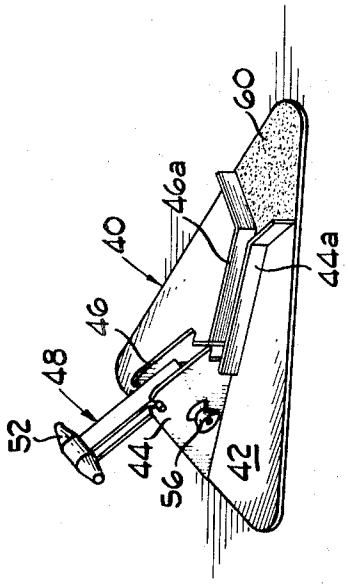

Fig 5

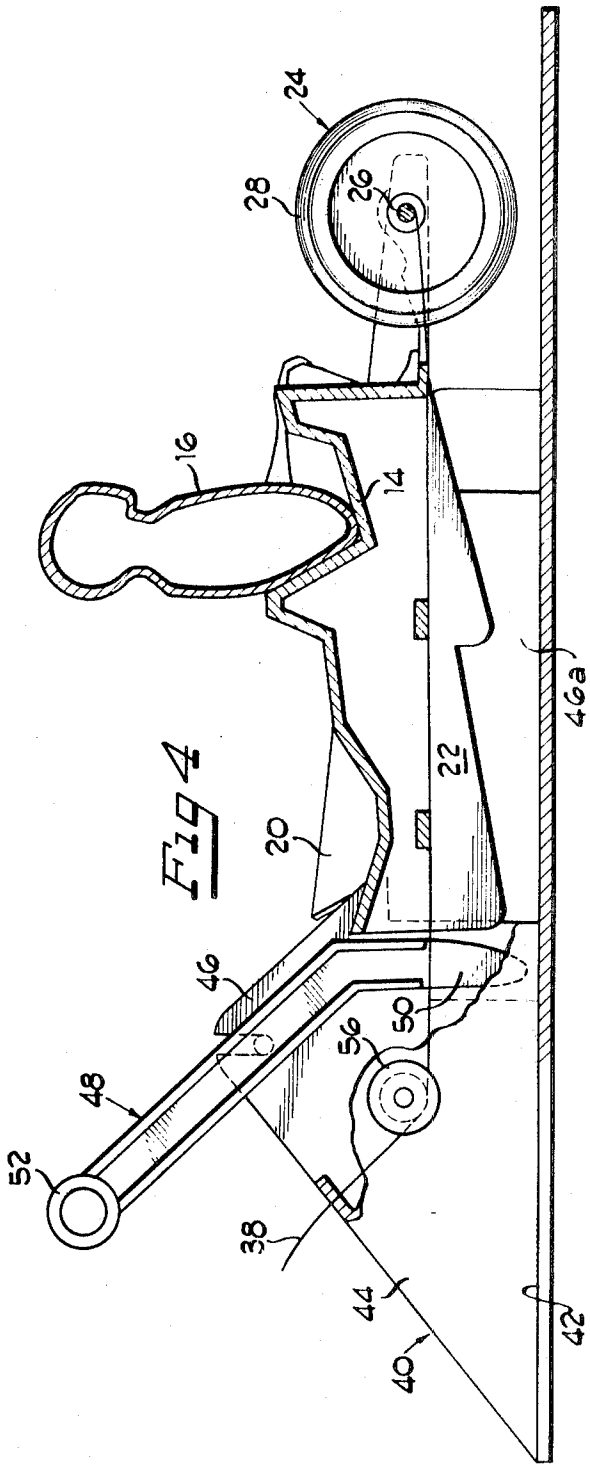

Fig 4

INVENTORS
HOWARD J. MORRISON
MARVIN I. GLASS

BY James V. Coffee
ATTORNEY

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3,621,607

SELF-PROPELLED TOY VEHICLE

Howard J. Morrison, Highland Park, and Marvin I. Glass, Chicago, Ill., assignors to Marvin Glass & Associates, Chicago, Ill.

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U.S. Cl. 46—206 11 Claims

ABSTRACT OF THE DISCLOSURE

A self-propelled toy vehicle wherein the supporting and driving means also provides a gyroscopic effect on the travel of the vehicle. The toy vehicle has mounted thereon a single supporting wheel in the form of a rotatable flywheel, which is capable of storing sufficient energy to provide a gyroscopic effect on the vehicle when the rotating flywheel is placed on a supporting surface. In the illustrated embodiment, the flywheel is wound with a string, similarly to the winding of a gyroscopic top, and a launching device is also provided in order to facilitate launching the device in a balanced condition and along a straight line.

BACKGROUND OF THE INVENTION

The present invention relates to toy vehicles and is particularly directed to a gyroscopic toy vehicle.

Toy vehicles have been quite popular with children for many years, both in the form of self-propelled vehicles and as manually propelled vehicles. Gyroscopic toys have also been somewhat popular, particularly gyroscopic tops. There have also been some instances wherein a gyroscopic rotor was combined with a toy vehicle so as to provide a source of driving energy for the supporting wheels of the vehicle. The present invention utilizes a gyroscopic rotor or flywheel as the self-propelling and supporting means for the vehicle as well as controlling the direction of travel and balance of the vehicle.

It is a primary object of the present invention to provide a toy vehicle having a single supporting wheel, wherein the supporting wheel is a flywheel or gyro rotor adapted to store energy and to transfer such energy directly to a supporting surface to propel the vehicle along a straight path. A further object of the invention is to provide a toy vehicle which has, as its sole support during motion, a rapidly rotatable flywheel and a ground engaging skid disposed rearwardly of the flywheel and parallel to the direction of rotation of the flywheel. Still another object of the invention is to provide a launching means for the above described vehicle, including means for supporting the vehicle in elevated relation to a supporting surface while effecting rapid rotation of the flywheel and means for moving the vehicle into a position of engagement between the flywheel and the support surface. Other objects and advantages will become apparent from the following description of the selected embodiments of the invention.

In the drawings:

FIG. 1 is a perspective view of a toy vehicle embodying the invention disclosed herein;

FIG. 2 is a top plan view of the toy vehicle with the driver-figure removed;

FIG. 3 is a cross-sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is a longitudinal, sectional view of a launching device for the vehicle, with the toy vehicle supported on the launcher in position for operation;

FIG. 5 is a perspective view of the launcher; and

FIG. 6 is a bottom plan view of the vehicle.

With reference first to FIGS. 1–3 of the drawings, it

will be noted that the selected embodiment of the invention is in the form of a futuristic appearing vehicle **10** including a body portion **12**, preferably of impact-resistant plastic, having a seat portion **14** thereon for supporting a driver-figure **16**, a simulated jet or turbine **18** at the rear of the vehicle, and simulated "stabilizing fins" **20** extending rearwardly along opposite sides of the body. The under portion of the rear part of the body or frame includes a narrow skid element **22** extending lengthwise of the frame in alignment with a gyroscopic rotor or fly wheel **24** disposed forwardly thereof on the vehicle.

The gyro rotor or flywheel **24** is fixed to a transverse shaft **26** and is formed to provide a substantial portion of its mass adjacent the periphery of the wheel to provide an energy-storing and transfer means. The flywheel is preferably metal with at least a portion of its outer circumference provided with a friction-producing material, such as a rubber O-ring **28** seated in a circumferential groove **30** in the flywheel. The opposite ends **32** of the shaft **26** are preferably of reduced cross-sectional area (FIG. 3) in order to minimize friction during rotation of the flywheel. As a further means for reducing such friction, the reduced ends **32** of the shaft are journaled in nylon bearings **34** or the like seated in transversly aligned bores formed in the frame. The flywheel shaft **26** includes a transverse opening **36** therethrough for insertion of a cord or string **38**, which is then wound around the shaft and provides means for effecting rapid rotation of the flywheel. The skid portion **22** on the body, as seen also in FIGS. 4 and 6, is of relatively narrow width so as to provide a minimum amount of friction as it moves along the supporting surface during propulsion of the toy vehicle, during which time the fly wheel **24** maintains the vehicle in a balanced state laterally of its longitudinal axis with only the flywheel and the skid **22** engaging the supporting surface. Preferably the skid is substantially narrower than the width of the flywheel and as a result the vehicle is laterally unstable when at rest.

In the operation of the toy, a cord **38** is inserted through the opening **36** in the axle **26** a short distance and the cord is then wound around the axle, similar to the preparation of a gyroscopic top for operation. The vehicle is then held in the user's hand by grasping the vehicle rearwardly of the flywheel, and the string **38** is pulled rapidly to thereby effect rotation of the axle or shaft **26** and start the flywheel **24** in motion. As the vehicle is then placed on the floor, so that it contacts the floor only at the circumference of the flywheel **24** and on the bottom edge of the skid **22**, the frictional bearing surface on the flywheel provided by O-ring **28** will grip the floor and propel the vehicle forwardly at a rapid rate. The flywheel or gyro rotor **24** will also serve as a gyroscope and maintain the vehicle in a straight line along the direction of rotation of the flywheel. This straight line propulsion of the vehicle will be further assisted by the skid **22**, which provides the only other contact with the supporting surface during propulsion of the toy. Thus the gyroscopically acting flywheel **24** provides support, balance, and direction, as well as the propelling means for the toy vehicle.

An additional novel feature of the described toy vehicle is that the vehicle automatically accelerates for a distance once the rapidly rotating flywheel has been placed in engagement with a supporting surface. Since the flywheel **24** serves both as the energy-storing means and the energy-transfer means to the supporting surface, there is a slight lag between initial transfer of energy and the maximum transfer of energy and, consequently, a resulting acceleration takes place at a point along the path of travel which is forward of the initial starting position.

In order to facilitate the launching of the vehicle,

particularly for younger children, there is provided a launching device **40**, which is seen in FIGS. 4 and 5. The launching device includes a platform **42** having formed therewith a pair of vertically extending side members **44** and **46** including relatively shallow sections **44***a* and **46***a*, respectively, at the forward end of the platform which are adapted to support the toy vehicle in slightly elevated relation to the platform. At the rear of the side members **44**, **46** there is pivotally mounted a launching handle or lever **48** disposed with an inclined forward end portion **50** of the lever in position to push the vehicle forwardly on the platform as the rear portion of the lever is depressed. To facilitate movement of the lever there is provided a transverse handle **52** at the upper end of the lever. In preparing for launching the toy vehicle **10** the cord **38** might be wound around the axle **26** clockwise, either before placement of the vehicle **10** in the launcher **40** or while the vehicle is in position on the launcher, as seen in FIG. 4. A length of the cord is brought rearwardly along one of the side members **44***a* and is guided around a pulley **56** which is rotatably mounted on the side member **44**. The launcher is preferably stabilized by placement of the user's knees or feet on opposite sides of the rear part of the platform **42**, and the end of the string is pulled upwardly from the position seen in FIG. 4. As the string is unwound from the axle **26** there is a resulting rapid rotation of the flywheel **24** which is being held free of the supporting surface by the side member portions **44***a* and **46***a*. Thereafter, the handle **52** is moved downwardly to provide engagement of the forward end portion of the lever **50** with the rear of the vehicle **10** and thereby cause the latter to move forwardly off of the supporting rails **44***a*, **46***a* to a position of engagement between the rotating flywheel **24** and the forward end of the platform or directly on to the supporting floor surface. The position of the vehicle on the rails **44***a*, **46***a* of the launcher is such that the described initial forward movement of the vehicle is guided along a straight line in the direction of rotation of the flywheel, so as to provide maximum efficiency in the operation of the self-propelled vehicle. At least the forward end of the launching pad which is initially engaged by the flywheel **24** is preferably roughened or otherwise provided with a surface of friction producing material, as indicated at **60**, so as to minimize the slippage of the flywheel with the surface as the flywheel moves downwardly into engagement therewith.

Although shown and described with respect to a particular embodiment, it will be apparent that various modifications might be made without departing from the principles of this invention. For example, other means might be employed for effecting rapid rotation of the flywheel, such as a pinion gear fixed on the flywheel shaft and an elongated rack (not shown) which is engageable with such pinion to effect rotation of the flywheel in a manner similar to that disclosed in U.S. Pat. 755,446. It will also be apparent that the vehicle can readily be made in various designs, as long as the weight of such vehicle body is related to the amount of energy capable of being stored and transferred to a supporting surface by the flywheel so that the latter is effective to produce rapid movement of the vehicle along a path determined by the direction of rotation of the flywheel. In this respect, it must also be borne in mind that the friction produced between the vehicle body and supporting surface must be minimized in order to avoid overloading the flywheel or disrupting the balance of the vehicle or the gyroscopic tendency of the flywheel to move along a straight line. In the illustrated embodiment of the invention, it has been found that a very wide skid or multiple skids disposed parallel to one another detract from the proper straight line propelling movement of the vehicle necessary to achieve maximum speed and length of the travel of the vehicle.

Furthermore, although the illustrated embodiment has the gyro rotor or flywheel at the forward portion of the vehicle other designs are also effective in achieving the results of this invention. The primary requisite is that the flywheel acts as a gyroscope and controls the balance and the direction of travel of the vehicle. This can be achieved even though the flywheel is disposed at a midportion or even rearwardly on the vehicle, as long as the weight of the vehicle frame is not so great as to disrupt the gyroscopic effect of the flywheel. In the latter respect, the distance of the center of gravity of the vehicle body from the axis of rotation of the flywheel is an obvious factor as well as the actual weight of the vehicle body. It will be apparent that optimum results are achieved in speed, balance and straight line operation of the vehicle, when the weight of the vehicle is quite small compared to the kinetic force or energy of the flywheel and the center of gravity of the vehicle body is coincident with the axis of rotation of the flywheel.

What is claimed is:

1. A toy vehicle comprising a body, a single supporting wheel mounted on said body for rotation relative thereto and in position for engagement with a supporting surface, said supporting wheel comprising a flywheel being capable of rotation at a speed sufficient to provide a gyroscopic action with respect to the entire vehicle, means for effecting rapid rotation of said flywheel, and said body being sufficiently light weight relative to the potential kinetic energy of the flywheel so as to respond to the gyroscopic action of said flywheel, whereby said flywheel serves as a gyroscopic rotor to guide the vehicle along a straight line as well as providing a balancing and supporting driving wheel for the vehicle.

2. A toy vehicle as set forth in claim **1**, including a skid support on the bottom of said vehicle in alignment with said flywheel.

3. A toy vehicle as set forth in claim **2**, wherein said flywheel is fixed to a shaft journalled in said body, with said shaft including a transverse bore spaced from said flywheel and adapted to receive one end of a flexible cord to be wound around said axle, whereby pulling of said wound cord provides rotation of said flywheel.

4. A toy vehicle as set forth in claim **1**, wherein said flywheel is fixed to an intermediate portion of an axle having reduced, opposite end portions, and journal bearing means on said body for receiving said reduced end portions of said flywheel axle.

5. A toy vehicle as set forth in claim **4**, wherein said flywheel is positioned forwardly on said body, and including an elongated, narrow rib on the bottom surface of said body extending rearwardly from and in alignment with said flywheel, so as to provide a supporting skid for the rear portion of said vehicle.

6. A gyroscopic toy vehicle comprising a frame structure, a gyroscopic rotor fixed to an axial shaft which is journaled at its opposite ends in said frame to position the periphery of said rotor outwardly of said frame and along the longitudinal axis thereof, a narrow, ground-engaging skid on said frame rearwardly of said rotor and parallel to the direction of rotation of said rotor, and means for effecting rapid rotation of said rotor while the latter is free of engagement with any surface, so that subsequent engagement of the periphery of said moving rotor with a supporting surface provides for an accelerating propulsion of said vehicle over the supporting surface while engaging said surface with said rotor and skid.

7. A gyroscopic toy vehicle as set forth in claim **6**, including means for launching said vehicle on to a supporting surface, which means comprises a platform mounting a pair of spaced-apart rail members adapted to support the vehicle with said rotor in elevated relation to the platform, and movable lever supported by said platform in position for engagement with the rear portion of said vehicle to move the latter off said rail members to a position of engagement between said rotor and a supporting surface.

8. A gyroscopic toy vehicle as set forth in claim 7, wherein said means for effecting rotation of said rotor includes a cord wound around the rotor shaft, and said launching means includes means for guiding the cord rearwardly along the platform to a position adjacent said movable lever, whereby the rotor can be set in motion by pulling on the cord while said vehicle is supported by said rail members and the vehicle can subsequently be launched through movement of said lever.

9. A toy vehicle comprising a body, a single supporting and driving wheel mounted on said body for rotation relative thereto and in position for engagement with a supporting surface, said supporting wheel comprising a flywheel having sufficient potential kinetic energy relative to the weight of said body to be capable of rotation at a speed sufficient to provide a gyroscopic action with respect to the entire vehicle as it propels said vehicle along a supporting surface, and means for effecting rapid rotation of said flywheel.

10. A toy vehicle as set forth in claim 9, including a ground-engageable support means on said vehicle in spaced relation to the axis of rotation of said flywheel.

11. A toy vehicle as set forth in claim 9, wherein said flywheel is fixed to a shaft journalled in said body, and wherein said means for effecting rapid rotation of said flywheel includes means on said shaft and a separate cooperable means which is engageable with said shaft means to rapidly rotate said shaft when engaged therewith and then moved relative to said shaft.

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ROBERT PESHOCK, Primary Examiner

D. L. WEINHOLD, JR., Assistant Examiner