

May 5, 1953

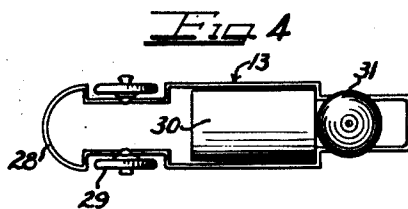
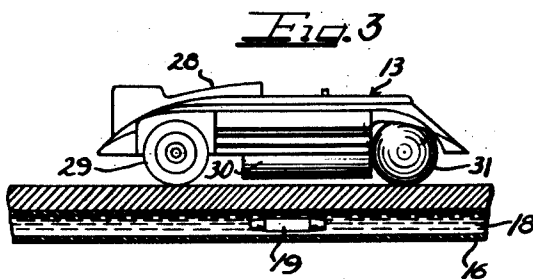
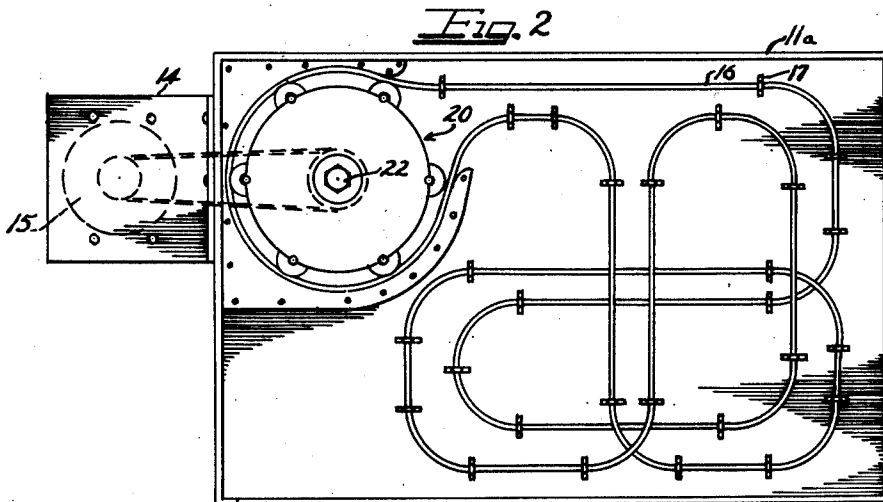
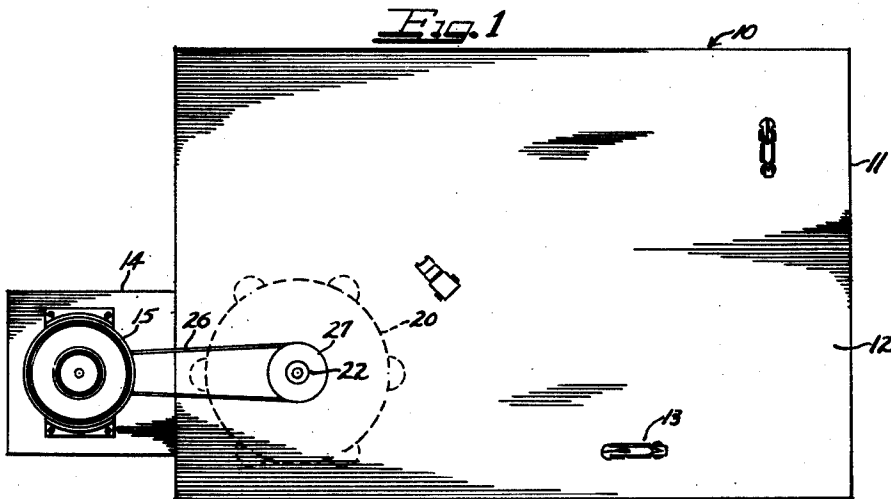
J. M. HOFF

2,637,140

TOY VEHICULAR SYSTEM

Filed Oct. 14, 1947

2 SHEETS—SHEET 1



Inventor  
JEAN M. HOFF

By *The Firm of Charles H. Hill* Attys.

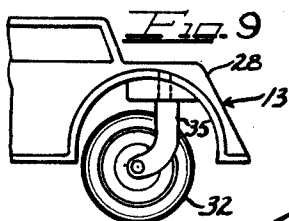
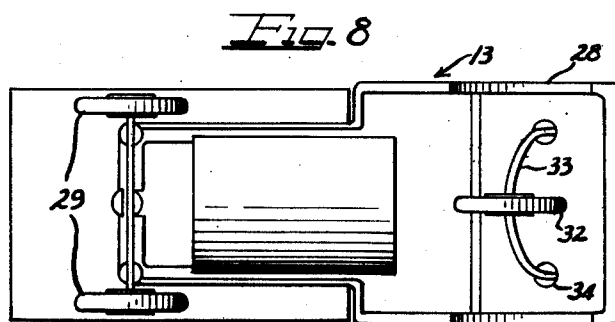
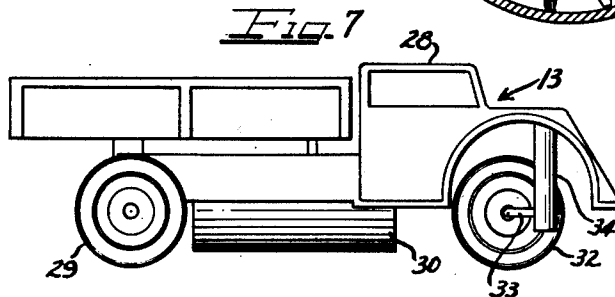
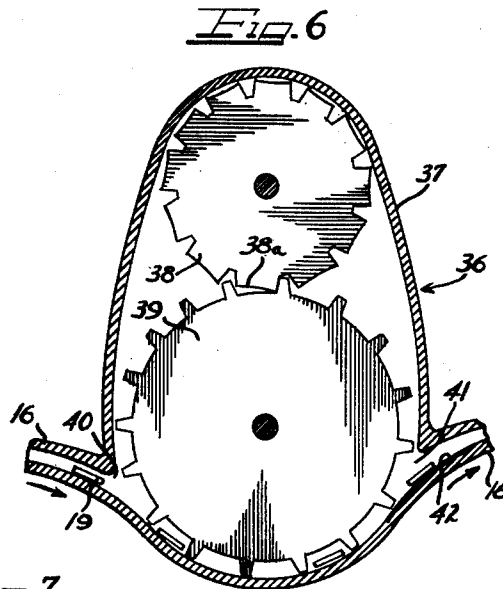
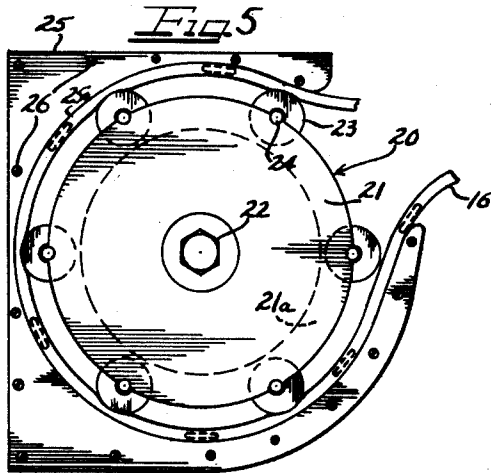
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TOY VEHICULAR SYSTEM

2,637,140

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2 SHEETS—SHEET 2



Inventor  
JEAN M. HOFF

*Testimony of Charles M. Hoff*  
Attys.

## UNITED STATES PATENT OFFICE

2,637,140

## TOY VEHICULAR SYSTEM

Jean M. Hoff, Evanston, Ill.

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3 Claims. (Cl. 46—45)

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The present invention relates to a toy vehicular system, and more particularly to a toy in which a wheeled vehicle is moved over a base surface by means of magnetic material disposed below the surface.

Toys which employ magnetic means for moving a vehicle over a surface are known in the art. However, the path traveled by such toy vehicles has been conventionally controlled by a guide rail, guide slot, or other similar means. Due to the necessity of such a guide rail or slot, the realistic appearance of such a toy has been reduced and the path followed by the toy vehicle has been restricted.

The toy vehicular system of the present invention comprises a concealed highway system including a number of curves and intersections above which toy vehicles move without visible driving means. Thus, the realistic appearance of the toy is increased, and the toy provides an educational and amusing illustration of the magnetic properties of matter. The vehicle may follow a fairly intricate path, without any apparent means of propulsion and thus give the appearance of moving under its own power. The path followed by the vehicle may be varied by a few simple adjustments of the apparatus as herein provided.

The supporting surface over which the vehicle travels is preferably a flat surface composed of wood, plastic or other non-magnetic material. The path followed by the wheeled vehicle over the surface is defined by an endless tube or channel made of glass, rubber, plastic, copper, or other non-magnetic material which is concealed beneath the surface of the highway. A viscous liquid, such as carbon tetrachloride containing dissolved rubber or heavy lubricating oil, is forced through the tube or channel by means of a suitable pumping apparatus. The pumping apparatus is preferably installed in the tubing system so that it may be concealed beneath the surface to form a simple integral system for the circulation of the liquid. The liquid, flowing through the tube or channel, serves to carry with it pellets of ferromagnetic material. These magnetic pellets may be in the form of permanent magnets or may be composed of non-magnetized magnetic material. The wheeled vehicles for use in the present invention are preferably miniature automobiles or trucks having a built-in permanent magnet or at least partially composed of magnetic material. The magnetic attraction between the vehicles and the pellets carried by the circulating liquid is sufficient to pull the vehicles along

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the path defined by the tube or channel beneath the surface. The vehicles have freely movable front wheels which may follow the abrupt curves and intersections of the system.

It is therefore an important object of the present invention to provide a toy vehicular system comprising a wheeled vehicle of magnetic material and magnetic means for determining the path along which the vehicle is propelled.

It is another important object of the present invention to provide a toy vehicular system comprising a supporting base, a wheeled vehicle of magnetic material for placing on the surface of the base, and magnetic means for propelling the vehicle and for determining the path of the vehicle.

It is a further important object of the present invention to provide a toy wheeled vehicle, at least partially composed of magnetic material, having rear wheels capable of rotation only and a freely movable front wheel.

It is a still further object of the present invention to provide a toy vehicular system comprising a supporting base, a wheeled vehicle of magnetic material for placing on the surface of the base in rolling engagement therewith, and means for circulating magnets in a viscous liquid beneath the surface of the base for propelling the vehicle and for determining the path of the vehicle.

Other and further important objects of the present invention will become apparent from the following description and the attached drawings.

Figure 1 is a top plan view of a toy vehicular system of the present invention;

Figure 2 is a bottom plan view of the toy vehicular system of Figure 1;

Figure 3 is an enlarged, fragmentary, cross-sectional view with parts shown in elevation of the toy vehicular system of Figures 1 and 2;

Figure 4 is a bottom plan view of a wheeled vehicle for use in the present invention;

Figure 5 is an enlarged, bottom plan view of a suitable pump assembly for use in the toy vehicular system illustrated in Figures 1 and 2;

Figure 6 is a bottom cross-sectional view, with parts shown in elevation, of a modified type of pump assembly which may be employed in the present invention;

Figure 7 is a side elevational view of a modified type of wheeled vehicle which may be employed in the present invention;

Figure 8 is a bottom plan view of the wheeled vehicle shown in Figure 7; and

Figure 9 is a fragmentary side elevational view

of a modified type of wheeled vehicle for use in the present invention.

In the drawings:

In Figure 1, reference numeral 10 refers generally to a toy vehicular system of the present invention, the toy comprising a supporting base 11 having a plane surface 12, and a plurality of wheeled vehicles 13 placed on the surface 12 in rolling engagement therewith. The supporting base 11 may be formed of any suitable non-magnetic material such as wood, aluminum, or copper. As shown in Figure 2, the supporting base 11 is formed with downwardly projecting vertical flanges 11a.

A platform 14 attached to the flange 11a carries an electric motor 15 rigidly attached thereto for a purpose to be hereinafter described.

Flexible tubing 16 is attached to the under surface of base 11 by means of suitable brackets 17, the extreme ends of the tubing being joined to form an endless passage. The tubing 16 is preferably curved as shown in Figure 2 for a purpose to be later explained. As best shown in Figure 3, the tubing 16 is filled with a viscous liquid 18. A suitable viscous liquid 18 may be prepared by dissolving a small amount of rubber in carbon tetrachloride to obtain a highly viscous fluid, or the liquid 18 may alternatively be a heavy lubricating oil preferably of an SAE number of approximately 49. A plurality of ferromagnetic pellets 19 are dispersed throughout the viscous liquid 18 contained in the tubing 16. The ferromagnetic pellets 19 may be composed of non-magnetized ferromagnetic material or may be permanent magnets. As used in the present application the term "magnetic material" refers to both magnetized and non-magnetized ferromagnetic material. It is preferred that the pellets 19 be permanent magnets prepared from alloys of iron, aluminum, nickel and cobalt. If desired the pellets 19 may be encased in a shell or casing of plastic or glass so that the pellet will have a density less than that of the liquid 18. Such encased pellets will float in the liquid 18 and will consequently require less pumping to effect their circulation. In the use of permanent magnet pellets 19, it is preferred that the pellets 19 be so introduced into the liquid 18 that like magnetic poles be adjacent each other to avoid clustering of the pellets due to magnetic attraction between the unlike poles of adjacent magnets. If desired "spacers" or pieces of non-magnetic material may be attached to the extremities of the pellets 19 to prevent loss of magnetic properties of the pellets through possible magnetic contact between adjacent pellets. The outside diameter of the pellets 19 is substantially less than the inside diameter of the tubing 16 so that the pellets 19 may pass freely through the tubing 16. The overall length of the pellets is such that the pellets may circulate through the tubing system without obstructing the curves of the tubing. The viscous liquid 18 containing the ferromagnetic pellets 19 is desirably circulated through the tubing 16 by means of a suitable pump assembly 20.

As may be seen in Figure 5, the pump assembly 20 comprises a cylindrical block 21 having an annular groove 21a formed in the curved surface thereof, the block 21 being mounted on shaft 22 which extends through base 11. A plurality of smaller cylindrical blocks 23 are rotatably mounted on shafts 24 attached to the outer periphery of block 21, the blocks 23 extending into the groove 21a. A support block 25 of flexible material, such as rubber, is attached to the under

surface of base 11 by screws 26. The tubing 16 is laid along surface 25a of support block 25, which surface 25a is concentric with block 21. The distance between the block support surface 25a and the smaller blocks 23 is less than the outside diameter of tubing 16, so that the tubing is compressed between the surface 25a and the blocks 23. It is necessary that at least that portion of tubing 16 which is in contact with support block 25 be flexible so that the tubing may be compressed. As the shaft 22 is revolved by motor 15 by means of belt 26 and pulley 27, the block 21 also revolves. As the block 21 revolves, the blocks 23 rotate about the axis of block 21. The blocks 23 simultaneously revolve about their own axes, the curved surfaces of the blocks 23 remaining in contact with the tubing 16. Thus, as the pump assembly 20 is operated by the electric motor 15, the tubing 16 is compressed and the viscous liquid 18 and the ferromagnetic pellets 19 are effectively pumped through the tubing 16. The flexible material of support block 25 prevents the jamming of the pump by the blocks 23 riding over a pellet 19 in tubing 16. In case a pellet should obstruct the movement of a block 23, the pellet will be pressed into the flexible block 25 and the block 23 may then ride easily over the pellet 19. The same effect may be obtained by spring mounting the blocks 23.

As hereinbefore stated it is necessary that the wheeled vehicles be at least partially composed of ferromagnetic material. The vehicle itself may be composed of ferromagnetic material or the ferromagnetic material may be attached to the vehicle. As shown in Figure 3, a suitable wheeled vehicle 13 for use in the present invention comprises a hollow non-magnetic body 28 preferably of plastic, and conventional rear wheels 29 which are capable of rotation only.

A cylindrical body 30 of magnetic material is inserted into the hollow central portion of the body 28 of the vehicle 13 and is securely held therein by means of a suitable adhesive. The magnetic body 30 may preferably be a permanent magnet prepared from an iron alloy containing cobalt, nickel and aluminum, or may alternatively be of non-magnetized magnetic material. A single freely movable front wheel is provided for the vehicle 13. As shown in Figures 3 and 4, a ball bearing 31 of ferromagnetic metal may preferably serve as a single front wheel. By the use of such a ball bearing 31 in combination with a permanent magnet 30, the necessity of supporting the wheel is eliminated, since the ball bearing is held in position by the magnetic attraction of the permanent magnet 30. The vehicle 13 is capable of turning in a very short radius, since the ball bearing 31 may rotate in any direction. A modified type of vehicle 13 is illustrated in Figures 7 and 8, and a still further modification is shown in Figure 9. As shown in Figures 7 and 8, the front wheel 32 of the vehicle 13 is a conventional rubber wheel which is rotatably mounted on the curved axle 33, the axle 33 being supported by cylindrical support members 34 which are attached at their upper extremity to the body 28 of the vehicle 13. The wheel 32 is free to move laterally along the curved axle 33 thus permitting the vehicle 13 to turn within a short distance so that it may follow the curves and intersections defined by the tubing 16. As illustrated in Figure 9, the steerable front wheel of the vehicle 13 may be of a conventional rubber tired wheel 32 mounted in a caster type mounting 35, the upper extremity of which is attached

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to the body 22 of the vehicle 13. The caster mounted wheel 32 also permits the rapid turning of the vehicle 13 within a very short distance so that it may follow the contour of the magnetic path provided by the tubing 16. It is possible to employ either magnetized or non-magnetized material as the magnetic material of the modified vehicles shown in Figures 7, 8 and 9.

In the operation of the toy vehicular system of the present invention, the circulation of the viscous liquid 18 through the tubing 16 is accomplished by means of the pump assembly 29, the viscous liquid 18 carrying the ferromagnetic pellets 19 through the tubing 16. It is desirable to form the pellets 19 from a relatively ductile ferromagnetic alloy, so that the pellets do not chip or break as they are pumped through the tubing system. A wheeled vehicle 13, placed upon the surface 12 in a position overlying a portion of the tubing 16, is moved across the surface 12 by the magnetic attraction between the ferromagnetic pellet 19 and the ferromagnetic portion of the vehicle 13. In order to insure an adequate magnetic attraction between the pellet and the vehicle, it is preferred that both the pellet and the ferromagnetic body 30 be formed from permanent magnets. However, it will be evident that sufficient attraction may be obtained by the use of only one magnet 19 or 30, the other being composed of non-magnetized ferromagnetic material.

In Figure 6, a modified type of pump 36 is illustrated which may be employed to circulate the viscous liquid 18 and the ferromagnetic pellets 19 through the tubing 16. The pump assembly 36 consists of a pump housing 37, preferably composed of the same material as the tubing 16, a driving gear 38 and a pumping gear 39. The driving gear 38 is connected to a suitable source of power such as an electric motor (not shown). The teeth of the driving gear 38 have arcuate outer surfaces 38a, the radius of curvature of the arcuate teeth 38a substantially the same as the radius of the pumping gear 39. The viscous fluid 18 and the ferromagnetic pellets 19 enter the pump housing 37 through port 40 in a direction which is substantially tangential to the outer periphery of pump gear 39. The pump gear 39 is preferably formed of a flexible material such as rubber, synthetic rubber or plastic, so that the teeth coming in contact with a ferromagnetic pellet 19 will bend and will not be broken. The pumping action of the pump gear 39 agitates the viscous fluid 18 and forces the fluid from the pumping chamber through port 41 into the tubing 16. If desired a plate 42 of ferromagnetic material may be inserted in the gear housing in

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a position adjacent to the port 41 to insure the removal of the ferromagnetic pellets 19, so that the pump 36 will not become fouled by the presence of ferromagnetic pellets 19 within the area defined by the gear housing 37. It is preferred that the entire gear assembly 36 be of non-magnetic material to avoid magnetic contact with pellets 19. By the use of the pump assembly 36, the tubing 16 need not be composed of flexible material and tubing composed of glass or of a suitable non-magnetic metal may be employed. Non-flexible tubing may be used in the system employing the pump illustrated in Fig. 5, since only that portion of the tubing in contact with the support block 25 need be flexible.

If desired the path of the wheeled vehicle 13 may be varied by simply removing brackets 17 and bending or otherwise forming the tubing 16 to the desired shape and holding the tubing in the desired shape by means of brackets 17.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. A toy wheeled vehicle comprising a body, rear wheels capable of rotation carried by said body, a single spherical front support, and means including a portion of said body partially confining said support for free rotation and movement therewith.

2. A toy wheeled vehicle comprising a body, a magnetic member carried by said body, rear wheels capable of rotation, and a single rotatable spherical front support of magnetic material held in steering position by said magnetic member.

3. A toy wheeled vehicle comprising a hollow, non-magnetic body, a permanent magnet mounted in said body, rear wheels capable of rotation, and a single rotatable spherical front support of magnetic material held in steering position by said magnet.

JEAN M. HOFF.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

| Number    | Name           | Date          |
|-----------|----------------|---------------|
| 1,171,972 | Myers          | Feb. 15, 1916 |
| 1,719,231 | McLaren        | July 2, 1929  |
| 1,740,496 | Cassidy et al. | Dec. 24, 1929 |
| 1,745,241 | Bartlett       | Jan. 28, 1930 |
| 2,239,395 | Mallory        | Apr. 22, 1941 |