MAGNETIC STEERING MECHANISM FOR TOY VEHICLES

Fig. 6

Fig. 7
MAGNETIC STEERING MECHANISM FOR TOY VEHICLES

Willy Werner, Quickborn, Holstein, Germany, assignor to North American Philips Company Inc., New York, N.Y., Corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A magnetic steering mechanism for a toy vehicle system. A permanent magnet in the form of a wheel is rotatably attached to the steering mechanism of the vehicle. A ferromagnetic strip is attached to a driving surface. Both the magnet wheel and the ferromagnetic strip have laterally adjacent pole pieces of opposite polarity. Each pole piece of the wheel overlies a pole piece having opposite polarity on the ferromagnetic strip thus providing a magnet system which urges the wheel into continuous alignment with the ferromagnetic strip.

The invention relates to a device for steering a toy vehicle driven by any suitable driving means along a given stretch on a driving surface without rails, the steering mechanism of the toy vehicle being provided with at least one permanent magnet which cooperates with a ferromagnetic strip which is arranged in or below the driving surface.

In a known device of this type, the ferromagnetic strips consist of a soft-magnetic wire, to which the permanent magnet in the toy vehicle adjusts during driving as a result of which the vehicle is steered along the wire. However, the permanent magnet which is secured to an arm of the steering mechanism can adjust in any direction with respect to the wire, including at an angle of 90° as a result of which a correct guiding and steering of the toy vehicle is impossible.

Another device for steering a toy vehicle is known in which permanent magnets are used. In this device a magnet is coupled to the steering mechanism outside the vehicle and over the driving surface a few separate permanent magnets are arranged which influence the permanent magnet steering mechanism in the vehicle. However, this device is complicated and expensive. In addition, this toy vehicle loses its attractiveness since the permanent magnets for steering are arranged more or less visibly on the driving surface.

According to the invention, the above drawbacks are mitigated with a device of the above-described type in that the ferromagnetic strip, which is substantially rectangular, consists of a permanent magnetic material, preferably a permanent magnetic oxide material, embedded in synthetic material or rubber comprising at least two pole pieces laterally disposed adjacent one another along the total length of the strip. The permanent magnet for the steering mechanism is constructed as a wheel running on the driving surface above the permanent magnetic strip which has at least two pole pieces with opposite polarity arranged laterally adjacent one another over the total circumference of the wheel and opposite the pole pieces within the strip. With this construction a forced steering of the vehicle is obtained.

It is noted that strips which consist of a permanent magnetic material, in particular barium and/or strontium hexaferrite, embedded in synthetic material or rubber, are already known and can be manufactured in a comparatively simple and cheap manner.

The permanent magnetic wheel may be magnetized in the axial direction and the permanent magnetic strip may be magnetized in a direction parallel to the driving surface.

In order that the invention may readily be carried into effect, a few embodiments thereof will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:

FIGURES 1a and 1b are a cross-sectional view and a plan view respectively of a device according to the invention.

FIGURES 2, 3 and 4 show cross-sectional views through the cooperating permanent magnets according to the invention illustrating the directions of magnetization of the said magnets.

FIGURES 5 and 6 diagrammatically show two embodiments of a toy vehicle according to the invention.

FIGURE 7 shows a connection constructed with the permanent magnetic guide strips.

FIGURE 8 diagrammatically shows a further embodiment of the toy vehicle according to the invention running on two guide strips.

In FIGURES 1a and 1b a flexible permanent magnetic strip 2 which is rectangular in cross-section is provided, for example, bonding, in arbitrary stretches below a flat thin driving surface 1 consisting of non-magnetic material, for example, wood, cardboard or synthetic material. When driving surfaces are used which are manufactured by hot-pressing synthetic material, grooves for receiving the strip 2 may be pressed in on the lower side. The flexible strip 2 consists of permanent magnetic material, in particular barium or strontium hexaferrite, embedded in synthetic material or rubber and may be manufactured in substantially any length by extrusion.

This permanent magnetic strip 2 serves as an invisible guide for a toy vehicle on the driving surface 1, which is driven by any suitable driving means. The steering mechanism of the vehicle is provided with a cylindrical wheel consisting of a permanent magnetic material, for example, barium or strontium hexaferrite, which is inserted or embedded in synthetic material or rubber. The wheel runs above the permanent magnetic strip 2 and follows the same. The wheel 3 has the same width as the permanent magnetic strip 2. An annular north pole and an annular south pole are formed on opposing radial surfaces of the wheel. On the side of the permanent magnetic strip 2 facing the wheel 3, two corresponding pole pieces with opposite polarity are arranged which are formed likewise by a bipolar transverse magnetization.

As a result of this magnetization, the wheel 3 is attracted by the permanent magnetic strip 2 and guided along the stretch formed by the strip. The plane of the cross-section through the centre of the wheel 3 always extends through the longitudinal axis of the strip 2.

The magnetizations of the wheel 3 and the strip 2 shown in FIGURES 3, are of the same type as in FIGURE 1a. In this case also the two parts of the magnet have a bipolar transverse magnetization; in this case the pole pieces have been displaced more towards the sides of the wheel and the strip respectively.

FIGURE 4 shows the wheel 3 and the strip 2 with a three-pole transverse magnetization. The circumference of the wheel 3 consequently comprises three annular pole pieces namely, as shown, two south poles and one north pole, while the side of the strip 2 facing the wheel likewise comprises three poles, namely two north poles and one south pole.

As shown in FIGURE 2, the wheel 3 is magnetized in the axial direction so that a pole piece is formed on each side face. Accordingly the strip 2 is magnetized in the direction parallel to the driving surface 1 with opposite polarity so that the pole pieces are arranged on the narrow side faces.
In all the cases the pole pieces on the permanent magnetic strip 2 are arranged laterally adjacent one another throughout the length of the strip.

FIGURES 5 and 6 diagrammatically show toy vehicles driven, for example, by a spring motor or an electric motor, consisting of a vehicle body with rear wheel drive. In FIGURE 5 the front wheels 6 are secured to the steering mechanism 7 which is secured to the permanent magnetic strip 3 by means of a rod 8. The wheel 3 can rotate with respect to the rod 8. When the wheel 3 runs on a driving surface above and along a permanent magnetic strip 2, the toy vehicle is moved along the stretch of the permanent magnetic strip by means of the wheel 3, the rod 8, the steering mechanism 7 and the front wheels 6.

In the toy vehicle shown in FIGURE 6, the wheel 3 is rotatably mounted on the vehicle body 4. In this case, the front wheels may be constructed as dummy wheels so that a three-wheel vehicle is obtained which is steered by means of the wheel 3.

Instead of only one permanent magnetic strip, two parallel strips may be used alternatively for the steering of the toy vehicle as shown in FIGURE 8. The two strips 2 in this case always cooperate with one of the permanent magnetic wheels which are used directly as front wheels 18 rotatably mounted on an axle of the vehicle. The rear wheels 19 may be permanent magnets also.

When the toy vehicle is driven by an electric motor, the current supply may be effected through conducting layers provided on the driving surface and touched by sliding contacts arranged on the vehicle.

FIGURE 7 shows two permanent magnetic strips 9 and 10 each forming a stretch which communicate with one another by means of a switch connection. For this purpose a short section 11 of the permanent magnetic strip 10 is arranged below the driving surface so as to be laterally slidable. Normally this section 11 is drawn against a stop member 13 by a spring 12. In this case the vehicle runs on the strip 10. The section 11 is also connected to a core 14 of an electromagnet 15, which, when actuated, attracts the section 11 against a stop member 16 so that the vehicle is conducted from the strip 10 to the strip 9.

What is claimed is:
1. A magnetic steering assembly for a toy vehicle system comprising a ferromagnetic strip including permanent magnetic material therein, said ferromagnetic strip being attached to a driving surface of said vehicle system and having at least two laterally disposed pole pieces of opposite polarity extending substantially the entire length thereof, and a permanent magnetic wheel coupled to a steering mechanism on said toy vehicle, wherein said permanent magnetic wheel overlies said ferromagnetic strip and includes a pair of pole pieces of opposite polarity located in laterally adjacent radial planes of said wheel, with each of the pole pieces of said magnetic wheel being in overlying aligned relation with a pole piece of opposite polarity of said ferromagnetic strip whereby said wheel is urged into continuous alignment with said ferromagnetic strip in response to the interaction of the magnetic fields therebetween.
2. A magnetic steering assembly as claimed in claim 1 wherein the permanent magnetic wheel is magnetized in the axial direction and the ferromagnetic strip is magnetized in a direction parallel to the driving surface.
3. A magnetic steering assembly as claimed in claim 1 wherein the permanent magnetic wheel is magnetized in the axial direction to define at least two annular pole pieces on the circumference of said wheel and the ferromagnetic strip is magnetize to define at least two laterally adjacent poles on the side facing said magnetic wheel.
4. A magnetic steering assembly as claimed in claim 1 wherein the ferromagnetic strip and the permanent magnetic wheel have equal widths.
5. A magnetic steering assembly as claimed in claim 1 wherein the ferromagnetic strip is flexible.

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LOUIS G. MANGENE, Primary Examiner.
R. F. CUTTING, Assistant Examiner.