

Feb. 5, 1963

M. ERNST

3,076,288

ELECTRIC LOCOMOTIVE FOR TOY RAILWAYS

Filed July 19, 1960

FIG. 1

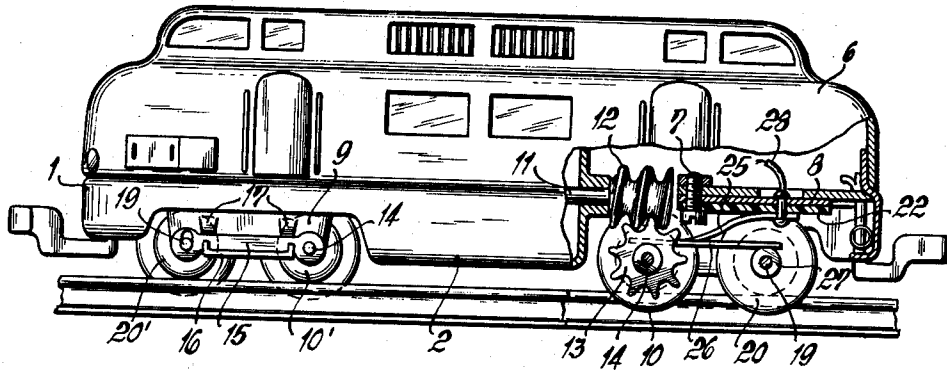


FIG. 2

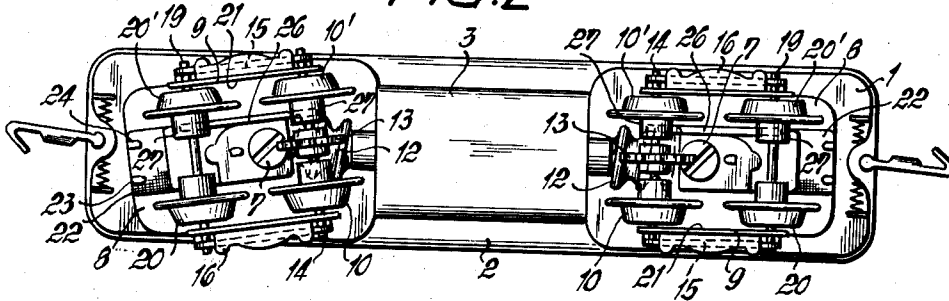
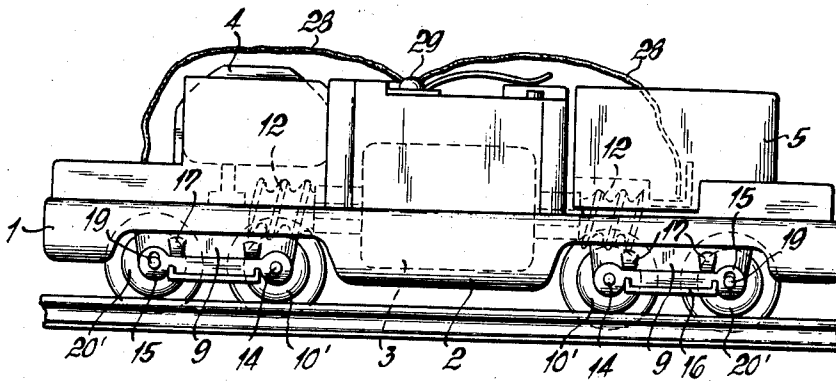


FIG. 3



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**ELECTRIC LOCOMOTIVE FOR TOY RAILWAYS**  
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Filed July 19, 1960, Ser. No. 43,929

Claims priority, application Germany July 22, 1959  
6 Claims. (Cl. 46-243)

This invention relates to electric locomotives for toy railways.

In designing electric toy railways, it is an object to achieve the closest possible similarity with full scale original models, at the same time from the point of view of saving in space reproducing the model on the smallest possible scale. Manifestly, the entire railway setup should operate in a reliable way, to this end providing the electric motor with a high starting torque and good hill-climbing ability. It is most important that the conduction of electric current from the rails or other means to the motor should be dependable and constant.

The present invention relates to the design of a rail locomotive for toy railways for fulfilling to a high degree the foregoing requirements.

Electric locomotives for toy railways are known in which the underbody or chassis of the vehicle is constructed from sheet metal in the form of an inverted U, to which are attached wheeled trucks. The electric motor that is mounted thereon may be provided with a rotor shaft extending in a lateral direction which may correspond generally with the direction of movement of the vehicle. The driven axles of the trucks' wheels may be provided with worm gears meshing with a worm on the driving shaft of the motor rotor. It is also known practice to mount the wheeled trucks of the vehicle on a vertical axis whereby the trucks are able to oscillate to conform to the curvature of the track.

It is a principal disadvantage of known arrangements in that a locomotive so designed cannot negotiate sharp curves.

It is an object of the present invention to avoid the foregoing and other disadvantages of known toy locomotive constructions.

It is a further object of the present invention to provide a toy electric locomotive with two wheeled trucks each oscillating about a vertical axis, each of said trucks being provided with one or two pairs of wheels.

It is a further object of the present invention to provide in a toy locomotive of the type described a driving shaft which extends over the driven axle of the truck in the longitudinal direction of the vehicle; namely, in the direction of movement thereof.

It is a further object of the present invention to provide in a toy locomotive of the type described the highest possible starting torque in a toy railroad of very narrow gauge, for example, gauge 10 mm.

It is a further object of the invention to enable the locomotive to negotiate very short radius curves whereby a small sized rail layout may be used.

## General Description

In accordance with the present invention, the driving worms on the motor shaft may be of conventional design; however, it is desirable that the worm gear mounted on the wheel shaft be designed to provide a certain amount of free play whereby when the truck is in diverted position as on rounding a curve, normal conditions of operation between the worm and worm gear will be maintained. According to this concept, the tooth profile of the worm gear should be arched.

The present invention provides the possibility of constructing toy locomotives wherein the trucks have one or two pairs of wheels with the vertical axis of oscillation of the truck placed at a relatively small distance from

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the power wheel axle. Where two trucks are provided, one wheel axle of each truck may be provided with a worm gear.

A particularly satisfactory operating arrangement of two-axle trucks results when only one of said pairs, namely, the one which is nearest to the motor, is provided with the driving means. In this case, the distance between the power wheel axle and the vertical axis of the truck should be smaller than the distance between the other wheel axle and the vertical axis. It is also desirable for effective transmission of power, that the wheel axles on each truck farthest from the motor, i.e. the non-driven wheels, mounted in vertical slits allowing a limited degree of vertical movement, the axle being placed under elastic tension by means of a spring.

In supplying electric current to electric locomotives for toy railways, the supply of current is furnished either through the rails per se or through the rails and a third current carrying element. In either case, current is derived from the rails, and if from these solely, they must be insulated electrically from each other. It has been common practice to collect electric current by means in direct mechanical contact with the rails.

In these previous arrangements, the drag between the brush and third rail has involved the loss by friction of a considerable amount of the available power. In the present invention, the current for the motor is picked up from the rails by the rolling wheels and from thence through specially designed hubs and brushes bearing thereupon.

According to the present invention:

(a) The current is supplied to the locomotive through the rails which are respectively insulated against each other;

(b) The wheels on one side of the vehicle are insulated from the wheels on the other side, and also from the body of the vehicle;

(c) The wheels are provided with an internally disposed hub;

(d) A current collecting member is provided on the lower side of the vehicle in such a manner as to bear elastically upon the hubs.

By these means, the loss by friction of electric current is very considerably reduced, permitting the reliable operation of an electric railway for an extremely small track width, for example, a track width of 10 mm. By avoiding overhead conveyance of current and by providing a plurality of means for picking up and conveying the current to the motor from the aforesaid hubs as much as four sources of contact may be provided for the locomotive and a much greater dependability in operation is thereby secured.

Further advantages and objectives of the present invention will appear in the course of the following description in connection with the drawings.

In the drawings FIG. 1 shows a side view of an electrically driven toy locomotive conforming with the present invention.

FIG. 2 shows the toy locomotive of FIG. 1 viewed from below.

FIG. 3 shows the locomotive according to FIGS. 1 and 2 with the upper body portion removed.

The locomotive according to the illustrated example is provided with a main body or chassis 1 wherein by means of the angled portions 2 there is mounted an electric motor 3. The body of the vehicle can be made of die-cast metal or of punched tin plate. The electric motor is of a conventional type having a commutator adapted to the use of a low tension direct current, the stator field being provided by a strong permanent magnet 4. The permanent magnet 4 has the advantage of serving as an added weight,

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If desired, the permanent magnet may be provided symmetrically arranged on both sides of the motor. According to the illustrated embodiment, a loading means 5 is provided on the side of the vehicle supported from the permanent magnet. The motor combination 3 and 4, and the loading means 5 are placed under the covering 6 which is removable from the main body of the vehicle. The locomotive thus has considerable weight for its size as a result of which it can develop high tractive power. Beneath the body of the vehicle there are provided vertical axes 7 carrying oscillating trucks 8 each of which consists essentially of a flat member and two downward directed wheel supporting members 9. The driving connection between the motor 3 and the two internal pairs of wheels 10, 10' is obtained by the extension of the motor shaft on both sides of the motor each extension carrying a screw 12 in meshing gear with the worm gear 13. The worm gears 13 are affixed on the axle 14 of the wheels 10 and 10'. The arched tooth profile of the worm gear 13 is illustrated in FIGS. 1 and 2.

The wheel axles on the trucks are secured by the provision on each side of said trucks of wheel supporting members 9, and brass supporting means 15. Members 15 are attached by means of reinforcing members 16 provided with small extensions 17 on the outside thereof between which the supporting means are maintained in their correct position. The external or non-driven wheel axles 19 are located together with wheels 20, 20' in vertical slots in said supporting journal means 15. The wheels 10' and 20' respectively are insulated from each other and are provided with an insulating layer 21 on the inside of the wheel supporting members 9. Furthermore, at the lower side of truck 8, insulating plates 22 are provided which may be fastened as with pegs 23 and 24 and are further affixed in place by means of the screw 7 which coincides with the vertical turning axis. An elastic metal strip or spring member 25 is connected with the insulating plate 22, the lower end thereof supporting two current collecting means 26. These current collectors 26 are in electrical contact with the internal hubs on said wheels 27. Through openings provided in the body of the vehicle and in the under carriage there are provided flexible conducting wires or cables which are electrically connected with the elastic metal strip 25. These serve as flexible connections between the oscillating truck 8 and the fixed motor contact 29. The external or non-driven wheel axles 19 on the embodiment shown are located in vertical slits as shown in FIGS. 1 and 3, the shoe or brush member 26 resting on the hubs of wheels 20, 20' maintain the latter in the lowermost position, but in yielding manner. A further supply of electric current to the motor is derived from the four other wheels which are grounded. In brief, for each of the two sources of current for the electric motor, there are provided four electric current collecting points thus providing a very effective means of maintaining a constant flow of current when the locomotive passes over switches or other portions of the track where the circuit is temporarily broken.

It will be noted, particularly in FIG. 1, that the worm gears 13 are relatively narrow and this permits the worm gears to tilt relative to their respective driving worms 12 as the trucks turn on their vertical axes. By locating the said vertical axis for each truck nearer to the driven axle of the truck than to the other axle, the movement of the worm gears relative to worms 12 as the trucks turn is held to a minimum and thus, there is always a driving connection between the worms 12 and worm gears 13.

Having described for purposes of better understanding a preferred embodiment of my invention what I claim and desire to protect by Letters Patent is as follows:

1. In an electrically driven toy locomotive; a body, a truck adjacent each end of the body pivoted thereto on a vertical axis, each truck having two axles and wheels on the ends of said axles, an electric drive motor carried by the body at about the middle thereof and having drive

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shaft means extending out both ends in the direction of movement of the locomotive, each drive shaft means having a drive worm thereon positioned over the axle of the adjacent truck, which axle is the one in the truck nearer to the drive motor, a worm wheel on each of the last-mentioned axles meshing with the pertaining drive worm, the wheels on one side of the locomotive being electrically insulated from the locomotive, the said axles in the trucks carrying the worm wheels being rotatable in the trucks on fixed axes and the other axles in the trucks being rotatable in the trucks and also being vertically movable therein, at least the said wheels which are insulated from the said locomotive being provided with inwardly extending hubs, a 2-armed current collector engaging the insulated hubs of each truck, and each truck having resilient yoke means carried thereby and supporting the pertaining said collector.

2. A toy locomotive according to claim 1 in which the said current collectors of the two trucks are electrically interconnected and are connected to one terminal of the electric drive motor, the other terminal thereof being connected with the other wheels of the locomotive which are not insulated from the locomotive.

3. A toy locomotive according to claim 1 in which the said worm wheels are relatively thin from side to side and the tooth flanks of the worm wheels being arched when viewing the worm wheels in the axial direction thereof.

4. A toy locomotive according to claim 1 in which the said current collectors of the two trucks are electrically interconnected and are connected to one terminal of the electric drive motor, the other terminal thereof being connected with the other wheels of the locomotive which are not insulated from the locomotive, the said worm wheels being relatively thin from side to side and the tooth flanks of the worm wheels being arched when viewing the worm wheels in the axial direction thereof.

5. A toy locomotive according to claim 1 in which the vertical pivot axes by means of which the trucks are connected to the locomotive body are located closer to the worm wheel-carrying axles of the trucks than to the other axles of the trucks whereby lateral movements of said worm wheels when the trucks pivot on the vehicle body are minimized so as to maintain driving connection between the driving worms and the said worm wheels at all times, said worm wheels being relatively thin measured in the axial direction and having arched tooth flanks when observed in the axial direction whereby to permit axial movement of the worm wheels as the trucks pivot without interference from the driving worms.

6. A toy locomotive according to claim 1 in which the said current collectors of the two trucks are electrically interconnected and are connected to one terminal of the electric drive motor, the other terminal thereof being connected with the other wheels of the locomotive which are not insulated from the locomotive, the vertical pivot axes by means of which the trucks are connected to the locomotive body are located closer to the worm wheel-carrying axles of the trucks than to the other axles of the trucks whereby lateral movements of said worm wheels when the trucks pivot on the vehicle body are minimized so as to maintain driving connection between the driving worms and the said worm wheels at all times, said worm wheels being relatively thin measured in the axial direction and having arched tooth flanks when observed in the axial direction whereby to permit axial movement of the worm wheels as the trucks pivot without interference from the driving worms.

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