In electrically operated toy or model railroads it is desirable to maintain the dimensions of the vehicles as small as possible to obtain by virtue of the particular smallness not only a saving of materials in the production but also a special buyer's appeal. The dimensions of such toy or model vehicles are determined primarily by the height of the structure and the location of the center of gravity, which determine the gauge of the track and the length on the basis of given proportions. The height of the structure, again, is determined particularly by the dimensions of the motor which furnishes the power. The size of the motors, however, was heretofore determined by the torque required for the operation of the toy train, and also limited by the fact that the production of motors of abnormally small dimensions requires an unusually great expenditure of time and labor and was therefore uneconomical. Therefore it was not possible in toy or model railroads to go below pre-determined dimensions in view of the structural height which was determined by the dimensions of the motor.

The invention is based on the surprising discovery that in spite of a given motor size and while maintaining that size it is possible to substantially decrease the structural height of an electrically operated toy vehicle and as a consequence to provide also for a decrease of the overall dimensions of the vehicle with respect to track gauge and length, if the motor is disposed in the vehicle in a particular manner.

The invention resides primarily in the concept of arranging the axes of the wheels of the vehicle within the field unit of the operating motor. This yields the surprising advantage that the motor and thus the center of gravity of the entire vehicle can be disposed unusually low so that a decrease in the structural height provides the great advantage of substantially decreasing the track gauge and the length of the vehicle. As regards the expenditure of labor and material this diminution introduces substantial advantages, not only with respect to the vehicles but also in the entire track arrangement.

According to another concept of the invention it is practicable to support the movable axle of the wheels directly in the field unit; this obtains the advantage that the field unit can be utilized at the same time as a supporting structural element for the movement mechanism of the vehicle so that the body of the vehicle is freed of all mechanical encumbrances and can be put over the field and motor simply as a light coupling. As a result of the light and simple construction a further decrease in the production costs can be obtained.

According to a further feature of the invention the diameter and therefore size of the motor and the torque produced by it can obtain an optimum maximum value if the field unit is formed of two symmetrical portions, for example U-shaped members, which rest against one another. In this manner the further advantage is obtained from a construction standpoint that the parts of the field unit can be simple and symmetrical castings. The two field units accommodate the required field windings such as, for example, one each winding for the forward motion and the second winding for the reverse motion of the vehicle. Vehicles having two separate field windings for the forward and reverse movement are known, per se. According to the invention, however, the cooperation of the two windings can be effected in such a manner that at one time they are connected in parallel and another time in series.

Further advantageous details are shown in the drawings in connection with an embodiment and where

Fig. 1 is a side view of an electrically operated vehicle having two axes,

Fig. 2 is an end or front view of the device shown in Fig. 1.

Fig. 3 shows a side view partly in cross section of an electric locomotive for a toy railroad embodying the principle of the invention shown in Figs. 1 and 2, and

Fig. 4 is a cross section taken along line IV—IV of Fig. 5.

The wheels a which may also be utilized for picking up the current rest firmly upon the axes b, which in turn are passed through the field units c and are journaled therein. The field units consist of two symmetrical portions, which may be U-shaped, as shown and which rest against each other. The field windings d may be constructed in the manner described above, i.e., they may cooperate with one another.

As shown in Figs. 3 and 4 the armature e of the electric motor is arranged within the field units c, which are provided with the windings d. The shaft f of the motor is provided with a small pinion gear g. The pinion g meshes with gear h which in turn meshes with gear i and gear i again meshes with a tooth rim k, provided, for example, on the inside of the left locomotive wheels a. The actual chassis for the locomotive is composed of two symmetrically formed supports l which may suitably be made of two die-castings. These supports l accommodate the shaft f of the rotor e and form the outer bearings for the axes b of the wheels of the locomotive. They project by means of sleeves m from both sides into the bores for the axes b of the wheels a in the field units c. The sleeves m are cast onto the two corresponding halves of chassis l.
ment and the wheels of the locomotive are covered by a body or cowling \( n \) which is in the form of a housing, open at the bottom, which is placed over the structure and is fastened to the two halves of the chassis \( I \) at certain predetermined places by means of screws or the like. The cowling \( n \) is preferably formed as a die-casting and has its greatest wall thickness at the sides, as may best be seen in Fig. 4, thus placing the center of gravity of the cowling also as low as possible. The basic inventive concept of disposing the field unit of the electrically operated vehicle in the range of the movement mechanism and, if desired, utilizing it as a supporting structural element may be employed in any other desired form without departing from the scope of the present invention.

Having thus fully described the basic principles of my invention and the manner of their application what I claim is:

1. An electrically operated toy or model railroad vehicle comprising a motor including a housing constituting a chassis, a rotor and a field unit, wherein the rotor is journaled in the chassis, wherein the axes of the wheels are disposed in adjacent legs of the field unit and are journaled inside the field unit and wherein the field unit comprises two symmetrical portions disposed one against the other.

2. An electrically operated toy or model railroad vehicle comprising a motor including a housing constituting a chassis, a rotor and a field unit, wherein the rotor is journaled in the chassis, wherein the axes of the wheels are disposed in adjacent legs of the field unit and journaled inside the field unit, and wherein the field unit comprises two \( U \)-shaped members disposed one against the other, one of said axes being disposed in each member.

3. An electrically operated toy or model locomotive comprising a motor, two axles and a pair of wheels associated with each of said axles, said motor comprising a field unit having a pair of identical substantially \( U \)-shaped pole pieces disposed with their legs extending towards each other and in horizontal alignment with each other, and a rotor supported centrally of said pole pieces, said axles being received in and extending through the lower legs of said pole pieces equidistantly from the ends thereof and equidistantly from the shaft of said rotor, and gears on one side of said locomotive intermediate said rotor and a wheel on said side.

4. An electrically operated toy or model locomotive comprising a motor, two axles and a pair of wheels associated with each of said axles, said motor comprising a field unit having a pair of identical substantially \( U \)-shaped pole pieces disposed with their legs extending towards each other and in horizontal alignment with each other, and a rotor supported centrally of said pole pieces, said axles being received in and extending through the lower legs of said pole pieces equidistantly from the ends thereof and equidistantly from the shaft of said rotor, and a plurality of gears intermediate said rotor and at least one of said wheels, disposed in planes parallel to the vertical planes of said wheels and with their axes in vertical alignment with the axis of said rotor.

5. An electrically operated toy or model locomotive comprising a motor, two axles, a pair of wheels secured to each of said axles, and a plurality of gears disposed intermediate said motor and one of each pair of said wheels; said motor comprising a field unit having a pair of identical substantially \( U \)-shaped pole pieces disposed with their legs rigidly extending towards each other and in horizontal alignment with each other, and a rotor supported centrally of said pole pieces, said axles being received in and extending through the lower legs of said pole pieces equidistantly from the shaft of said rotor, and said gears being disposed with their axes in vertical alignment with the axis of said rotor.

6. In an electrically operated toy or model locomotive, electromotive driving means adapted to provide a large driving force within small dimensions of gauge and height, said driving means comprising a motor having a rotor, and a field unit wherein two symmetrical \( U \)-shaped pole pieces having rigid upper and lower leg portions extend horizontally towards each other, and wherein the axes for the wheels of said locomotive are received in said lower leg portions with their axes equidistant from the axis of said rotor and in horizontal alignment with each other.

7. In an electrically operated toy or model locomotive having small dimensions of gauge and height, electromotive driving means for a large driving force within said small dimensions, said driving means comprising a motor having a rotor and a field unit wherein two symmetrical \( U \)-shaped pole pieces having upper and lower leg portions extend horizontally towards each other, wherein the axes for the wheels of said locomotive are disposed in said lower leg portions with their axes equidistant from the axis of said rotor, equidistantly from each other and from the ends of said field unit and at points above the lowest point in the area of rotation of said rotor.

8. In an electrically operated toy or model locomotive having small dimensions of gauge and height, electromotive driving means to provide for a large driving force within said small dimensions, said driving means comprising a motor having a rotor and a field unit wherein two symmetrical \( U \)-shaped pole pieces having upper and lower leg portions extend horizontally towards each other, and wherein the axes for the wheels of said locomotive are disposed in said lower leg portions with their axes equidistant from the axis of said rotor, equidistantly from each other and from the ends of said field unit and at points above the lowest point in the area of rotation of said rotor, and wherein the wheels of said locomotive are disposed wholly within an area of less than the longitudinal extent of said field unit.

EUGEN ENGBELHARDT.

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