May 25, 1926. 1,586,221

W. SCHWARZENHAUER

ELECTRIC TOY LOCOMOTIVE WITH ELECTRIC REVERSING GEAR

Filed Oct. 4, 1924 3 Sheets-Sheet 1

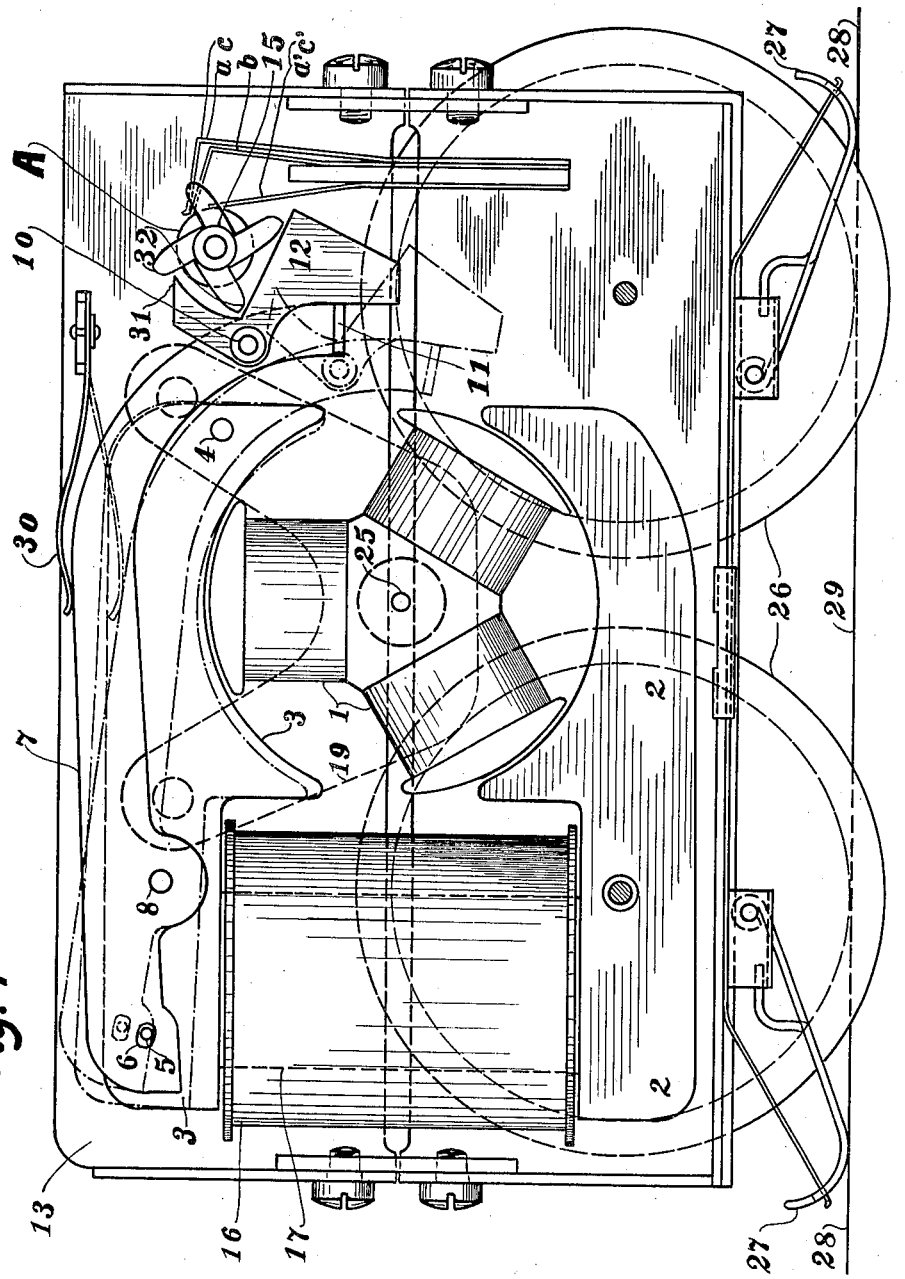

Fig. 1

Inventor.
Walter Schwarzenhauer
by Fred Thum
Atty

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W. SCHWARZENHAUER

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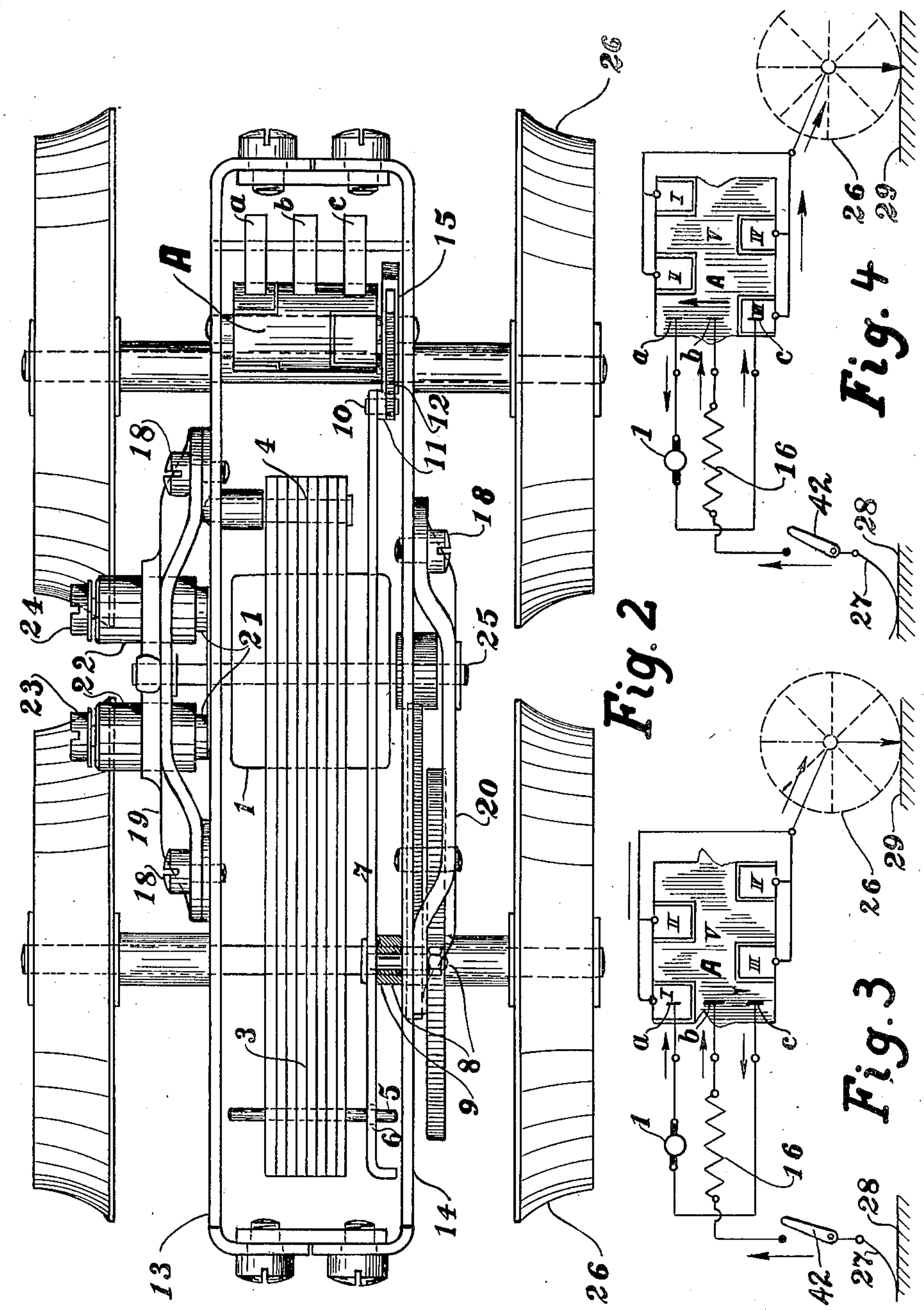

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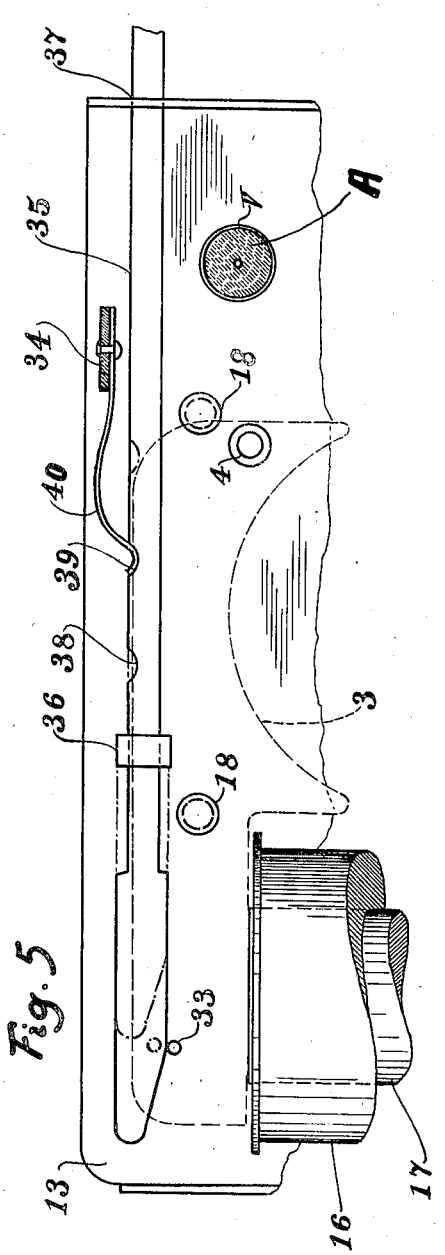

Fig. 5

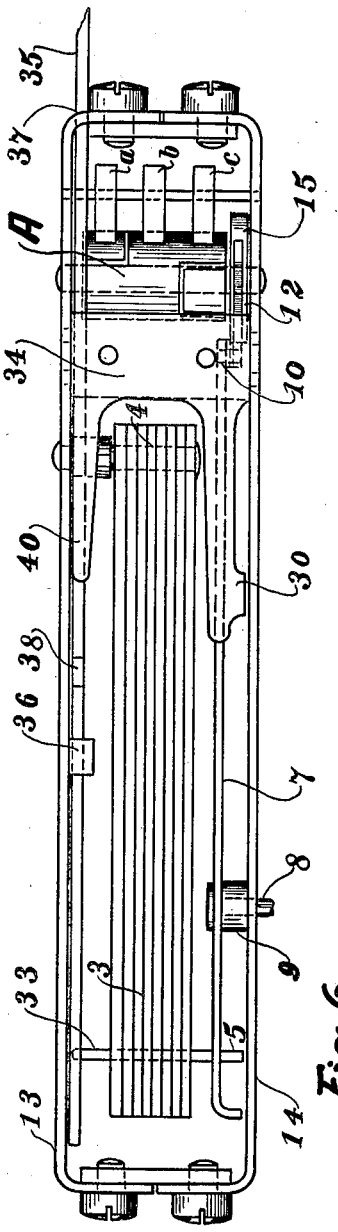

Fig. 6

Inventor:
Walter Schwarzenhauer
By Fred Munch
Attorney

Patented May 25, 1926. 1,586,221

UNITED STATES PATENT OFFICE.

WALDEMAR SCHWARZENHAUER, OF ELTERSDORF, GERMANY, ASSIGNOR TO BING WERKE, OF NUREMBERG, GERMANY.

ELECTRIC TOY LOCOMOTIVE WITH ELECTRIC REVERSING GEAR.

Application filed October 4, 1924. Serial No. 742,091.

In electric toy railways the motor is generally made reversible by means of an electric commutator built in and designed to change the direction of current in the armature or magnet circuit. The changing-over is usually effected by hand. Constructions have become known recently in which the commutator is electro-magnetically controlled. Toy locomotives with electric automatic reversing possess in comparison with locomotives with hand operated reversing gear the advantage that they can be controlled when running and from a distance whereby the playing becomes more interesting. In these electro-magnetic reversing gears the reversing is generally effected through the intermediary of a special electromagnet which is excited when the current is switched in.

This invention has for its object to eliminate this separate electromagnet and to utilize for this purpose the field magnet of the motor. With this object in view the iron of the field magnet is, according to the invention, separated at a point transversely to the direction of the lines of force so that the magnet is divided into two parts which attract one another electro-magnetically when the magnet is being excited. The pulling forces produced are transferred by convenient means upon the electric reversing gear of the motor.

An embodiment of the invention is shown, by way of example, on the accompanying drawing, in which:

Fig. 1 shows in side elevation the driving and reversing elements of an electric toy locomotive, the side wall being removed.

Fig. 2 is a plan view of the locomotive.

Figs. 3 and 4 are two connection diagrams.

Figs. 5 and 6 show the elements which serve for adjusting the locomotive for one direction running.

A three-polar armature 1 rotates between a stationary lower pole shoe 2 and an upper pole shoe 3 oscillatable around a bolt. The pole shoes are subdivided in order to improve the magnetizing. The oscillatable left part of the upper pole shoe 3 has a pin 5 engaging with a slit 6 of a two-armed switch-lever 7. The switch lever 7 pivots around a screw bolt 8, an intermediary ring 9 serving to determine the distance from the side wall 14. The switch lever 7 carries on its right, downwardly bent arm a ratchet pawl 12 pivotable around a bolt 10 and bearing against a stop 11 on the lever 7. A switch cylinder or block A with a ratchet wheel 15 having four teeth is arranged at the right of the pole shoe 3 and mounted between the side walls 13 and 14. Three switches or brushes a, b, c in the form of springs serve for reversing the current and bear upon the switch cylinder A. The switches or brushes a' and c' are auxiliary brushes frictionally engaging the cylinder A and have no influence on the controlling. At the left of armature 1, between the left hand ends of pole shoes 2 and 3 a magnet coil 16 with stationary iron core 17 is arranged.

The armature shaft 25 is mounted in V-shaped traverses 19 and 20 fixed in the side walls 13 and 14 by screws 18. The traverse 19 carries further the contact sleeves 22, in which the sliding carbons 21 are mounted. On said contact sleeves 22 the leading wires are fixed by means of screws 23 and 24, said wires coming from the brushes a and c and from the switch cylinder A. In the traverse 20 the transmission wheels are mounted which serve to drive the wheel axle. The power transmission from the armature shaft 25 to the axle of the left running wheel 26 is effected for instance by two pairs of toothed wheels.

The current is taken by two sliding shoes 27 from the central rail 28 of the track, the current being led off through the car body over the running wheels 26 and the outer rails 29. The electric circuit is controlled by a switch of usual construction and mode of operation, indicated diagrammatically at 42 in Figs. 3 and 4.

The reversing of the direction of running is effected by the reversing of the current in the armature. At circuit closing a strong magnetic field is produced in the magnet coil 16, said magnet field attracting the oscillatable pole 3. The movement of pole 3 is transferred by the curved switch lever 7 pivoting around the fulcrum 8 at first upon the ratchet pawl 12 and from the same through the intermediary of the ratchet wheel 15 upon the switch cylinder A. The distribution of weight in the ratchet pawl 12 is regulated in such a manner that this pawl in its positions of rest bears always against the stop 11 of the switch lever 7. The switch lever 7, ratchet pawl 12 and pole 3 are indicated in Fig. 1 by dot and dash lines.

in the position of rest. The full lines show these parts at work.

When the current is interrupted the iron core 17 of coil 16 loses its attracting power and releases the pole 3. A spring 30 of a spring bridge 34 presses the switch lever 7 in downward direction. At the same time the left hand extension of lever 7 raises the bolt 5 and with it the pole 3. At the descent of the right end of switch lever 7 the ratchet pawl 12 is drawn along; it rotates around the bolt 10 so that the nose 31 can slip over a tooth 32 of the ratchet wheel 15 without rotating said ratchet wheel. As soon as the nose 31 has passed the point of the tooth 32 the ratchet pawl 12 drops back into its normal position (see Fig. 1 position shown in dash and dot lines). The lower part of the ratchet pawl 12 comes in contact with stop 11 of the switch lever 7 and remains in this position when, by the switching in of the electric current, the pole 3 is attracted by the iron core 17 of coil 16 and the right hand end of the switch lever 7 with the ratchet pawl is raised again, said right hand part of the switch lever being connected with the pole 3 by the pin 5 and slit 6. The nose 31 of ratchet pawl 12 grips under a tooth 32 of the ratchet wheel 15 and rotates this ratchet wheel and the switch cylinder A through 90° in clockwise direction. The motor is reversed and the direction of travel has been changed.

The three switches or brushes *a*, *b* and *c* electrically combined in convenient manner with the screws 23, 24 and the magnet coil 16 of the motor, have a sliding contact with the switch cylinder A for the electric control of the motor. The shape, number and distribution of the switch segments can be seen from the developments of the switch cylinder A shown in Figs. 3 and 4. The switch cylinder A traverses at one complete revolution four switching positions, of which two are designed for the running forward of the motor and two for the running backward of the same. The four contacts I, II, III and IV are electrically connected with the axle of the switch cylinder A, this axle being electrically connected with the running wheels 26 of the vehicle. The remaining sliding surface of the switch cylinder A is coated with an insulated metal sheet V and electrically connected alternately with the armature 1 or with the magnet coil 16 by the three brushes *a*, *b*, *c*.

In Fig. 3 (switch position for running forward) the current takes the following course: central rail 28, sliding shoe 27, magnet coil 16, brush *b*, contact sheet metal V, brush *c*, armature 1, brush *a*, contact I, to the running wheel 26 and to the outer rail 29.

By renewed switching in of the electric current the ratchet wheel 15 with the switch cylinder A is rotated through 90°. The brushes *a* and *c* change to the position shown in Fig. 4 and the current in the armature flows in reverse direction. The brush *b* keeps the contact V.

In Fig. 4 (switch position for running backward) the current follows the following course: central rail 28, sliding shoe 27, magnet coil 16, brush *b*, contact sheet metal V, brush *a*, armature 1, brush *c*, contact III to the running wheel 26 and to the outer rail 29.

Every switching in of the electric current or every lowering of the pole 3 produces an oscillation of the switch lever 7 and consequently a rotation of the ratchet wheel 15 and of the switch cylinder A through 90° and a reversing of the motor.

If the locomotive has to run only in one direction the uniform direction of travel can be ensured either by a short twofold switching in or by pushing a bolt 35 which acts upon a pin 33 and retains the oscillatable pole 3 on the iron core 17 (compare Figs. 5 and 6). By a loop 36 and by a slot 37 in the frame of the locomotive the bolt 35 is guided on the side wall 13. A spring 40, made in one piece with spring 30 and mounted on the spring bridge 34 is adapted to come in engagement with the notches 38, 39 whereby the bolt 35 is securely held in its two extreme positions. The position of bolt 35 indicated in full lines shows the locking of pole 3 on the iron core 17. The dash and dot lined position of the locking bolt 35 shows how it releases the pin 33 and thereby the pole 3 so that this pole effects at every switching in of the electric current automatically a reversing of direction of travel of the locomotives.

The manner to maintain the locomotive in the same direction of travel by a twofold brief switching-in is liked very much as the train pushes at first back before it starts in forward direction. This is very similar to the starting of a real train.

I claim:—

1. Improvement in electric toy locomotives with electric reversing gear, comprising in combination a motor, switch elements of said motor, an electro-magnet in said motor, a magnet frame in said motor composed of several elements, one of said elements being subdivided transversely to the direction of the lines of force and movable with regard to the whole magnet so that the magnetic pulling forces produced between the several parts at the switching in of the motor are utilized for controlling said switch elements of the motor.

2. Improvement in electric toy locomotives with electric reversing gear, comprising in combination a motor, switch elements of said motor, an electro-magnet in said motor, a magnet frame in said motor composed of several elements, several of said

elements being subdivided transversely to the direction of the lines of force and movable with regard to the whole magnet so that the magnetic pulling forces produced between the several parts at the switching in of the motor are utilized for controlling said switch elements of the motor.

3. Improvement in electric toy locomotives with electric reversing gear, comprising in combination a motor, an electromagnet in said motor, a magnet frame in said motor composed of several elements, one of said elements being subdivided transversely to the direction of the lines of force and movable with regard to the whole magnet so that the magnetic pulling forces produced between the several parts at the switching in of the motor are utilized for controlling said switch elements of the motor, pole shoes on said magnet frame, a bolt around which one of said pole shoes can oscillate, a switch lever adapted to be oscillated by said oscillable pole shoe when the circuit is being closed, a spring controlling said switch lever, a ratchet pawl on said switch lever, a switch cylinder, and a ratchet wheel on the axle of said switch lever rotated by said ratchet pawl.

4. In an electric toy locomotive with electric reversing of the type described a locking bolt to be operated by hand for locking the oscillable pole on the iron core in order to lock the switch elements for the reversing.

5. A reversing mechanism for toy electric locomotives having in combination with the field magnet of the motor which drives the locomotive, a rotatable switch block having a plurality of insulated contact pieces, a series of switch springs adapted to contact with different parts of the switch block according to the position of the latter, a ratchet wheel connected with the switch block, a lever carrying a pawl at one end adapted to engage with the ratchet wheel to actuate the switch block, magnetic means connected with the other end of the lever located to be actuated by the magnet when the latter is energized, a circuit in which the magnet is located, and a switch for opening and closing the circuit.

6. A reversing mechanism for toy locomotives having in combination with the field magnet of the motor for driving the locomotive, a rotatable switch block having insulated contact pieces, a series of springs adapted to contact with different parts of the block according to the position of the latter, a lever having means for engaging and turning the switch block, a magnetic member connected with one end of said lever and located so as to be actuated by the magnet when the latter is energized, a circuit in which the magnet is located, and a switch for closing and opening the circuit.

7. A reversing mechanism for toy locomotives having in combination with the field magnet of the motor which drives the locomotive, a movable top pole piece having one end located over the core of the magnet and adapted to be drawn thereto when the magnet is energized, a circuit is which the field magnet is located, a switch for controlling the circuit, a lever one end of which is loosely connected with the movable end of the top pole piece, a movable switch block, a series of springs adapted to contact with different parts of the switch block according to the position of the latter, and means carried by the free end of the lever for moving the switch block when the lever is actuated during energization of the field magnet.

8. A reversing mechanism for toy electric locomotives having in combination with the field magnet of the motor of the locomotive, a rotatable switch block having insulated contact pieces, a series of springs adapted to contact with different parts of the switch block according to the position of the latter, a ratchet wheel connected with the switch block, a lever carrying a pawl at one end for operating the switch block through the ratchet wheel, means carried by the lever for holding the ratchet wheel in its moved position while the current is on, a piece of magnetic metal connected with the other end of the lever and located to be moved by the field magnet when the latter is energized, a circuit in which the magnet is located, and a switch in the circuit.

9. A reversing mechanism for toy electric locomotives having in combination with the field magnet of the motor of the locomotive, a rotatable switch block having at each end an insulated contact piece, a series of three switch springs adapted to contact with different portions of the switch block according to the position of the latter, means for imposing frictional pressure on the switch block, a ratchet wheel connected with the switch block, a lever carrying on one end a pawl for operating the ratchet wheel to turn the switch block, a movable pole piece having its movable end loosely connected with the other end of the lever, means for lifting the movable end of the pole piece clear of the magnet, and a circuit in which the magnet is located, the closing of which energizes the magnet to draw the movable end of the pole piece toward the magnet and thereby actuate the lever to turn the switch block.

10. A reversing mechanism for toy electric locomotives having in combination with the field magnet of the motor for driving the locomotive, a reversing switch block having two insulated contact pieces, two contact springs, each contact spring being located to engage with its contact piece alternately with the engagement of the other

contact spring with its contact piece, a third contact spring in engagement with the block whatever the position of the latter, a movable pole piece, means for holding one end of the pole piece disconnected from the field magnet while the latter is unenergized, and means connected with the pole piece for shifting the position of the switch when the free end of the pole piece is drawn to the magnet through the energization of the latter, a circuit in which the magnet is located, and a switch in the circuit.

11. A reversing mechanism for toy electric locomotives having in combination with the field magnet of the motor for driving the locomotive, a reversing switch block, a series of springs adapted to contact with different parts of the switch block according to the position of the latter, and means for shifting the position of the switch block comprising a movable pole piece having its free end adjacent one end of the core of the field magnet, a lever loosely connected with the free end of the pole piece arranged to engage and shift the position of the switch block when the pole piece is drawn to the magnet upon the energization of the latter, said lever acting to disconnect the free end of the pole piece from the magnet when the latter is not energized, and a switch controlled circuit in which the magnet is located.

12. A reversing mechanism for toy electric locomotives having in combination with the field magnet of the motor for driving the locomotive, a reversing switch block, means for shifting the position of the switch block comprising a lever arranged to engage and move the switch block, magnetic means connected with one end of the lever and arranged to be drawn to the magnet when the latter is energized to actuate the lever to move the switch block, means for holding the magnetic piece disconnected from the magnet when the latter is deenergized, a switch controlled circuit in which the magnet is located, and means for holding the lever inoperative to permit the locomotive to travel in only one direction.

13. A reversing mechanism for toy electric locomotives having in combination with the parts of the motor for driving the locomotive, a movable switch block, a series of switch springs adapted to contact with the various parts of the switch block according to the position of the latter, means actuated by the field magnet when the latter is energized for shifting the position of the switch block to reverse the direction of current flow through the motor, a circuit in which the magnet is located, and a switch for making and breaking the circuit.

14. A reversing mechanism for toy electric locomotives having in combination with the parts of the motor for driving the locomotive, a movable switch block for controlling the direction of current flow through the motor, a series of switch springs adapted to contact with different parts of the switch block according to the position of the latter, a movable member for actuating and shifting the position of the switch block, a part composed of magnetic material connected with the movable member and arranged to be drawn into contact with the field magnet when the latter is energized to move the member to actuate the switch block, said member being arranged to fall by gravity into normal position when the magnet is deenergized, a circuit in which the magnet is located, and a switch for closing and breaking the circuit.

In testimony whereof I affix my signature.

WALDEMAR SCHWARZENHAUER.