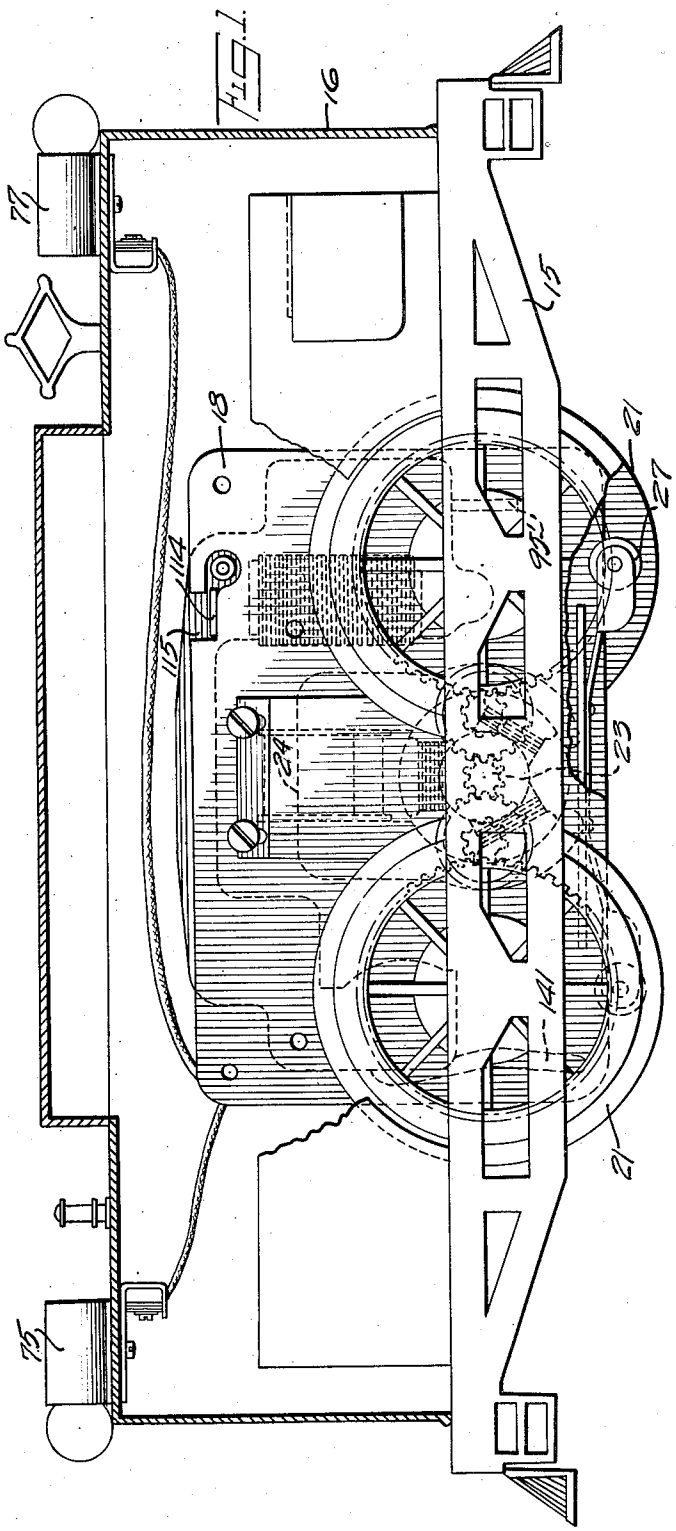
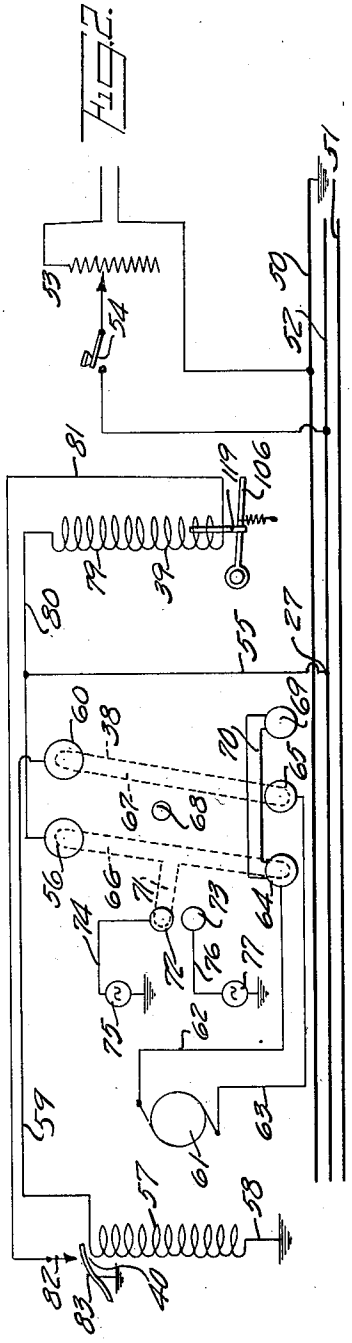
June 24, 1930. L. CARUSO 1,766,329

REVERSIBLE ELECTRIC LOCOMOTIVE

Filed July 20, 1926 3 Sheets-Sheet 1





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REVERSIBLE ELECTRIC LOCOMOTIVE

Filed July 20, 1926 3 Sheets-Sheet 2

FIG. 5a

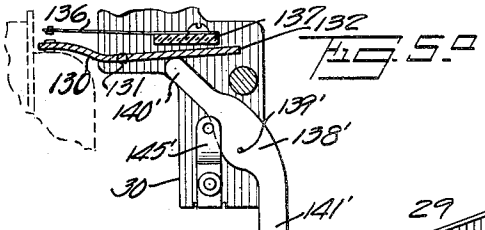


FIG. 3.

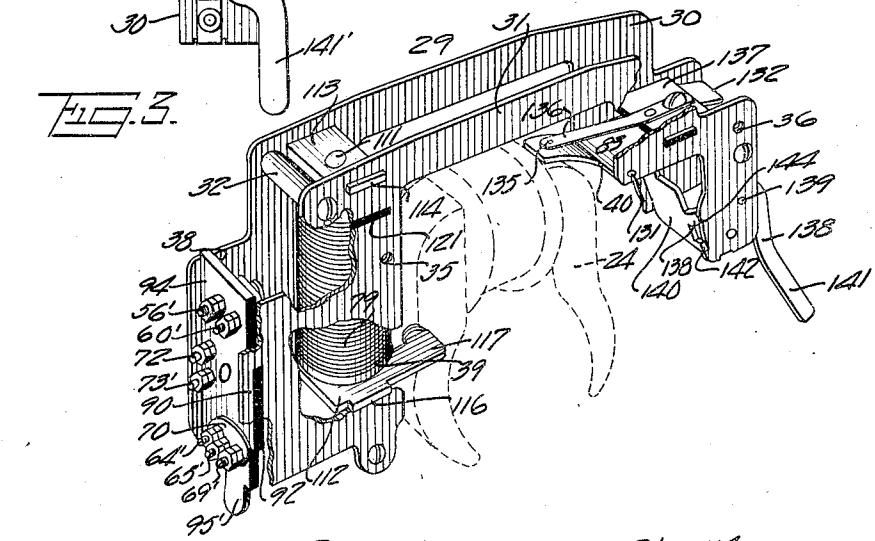


FIG. 4.

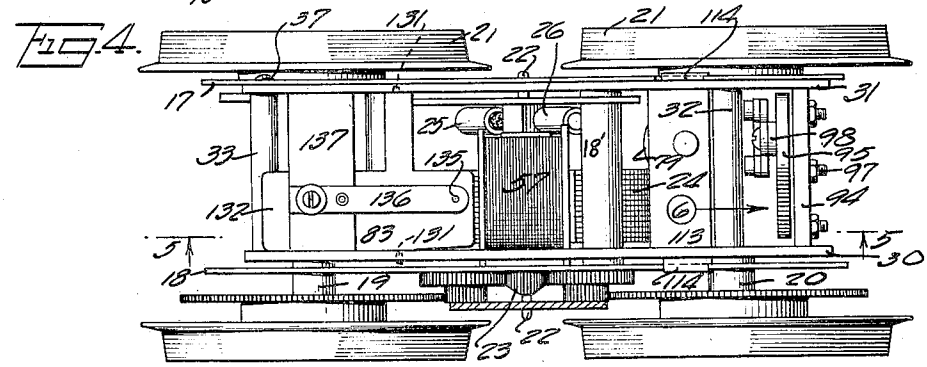
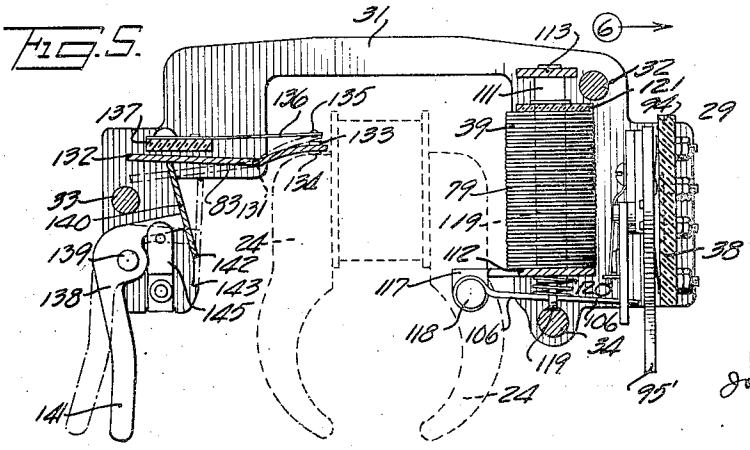


FIG. 5.



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REVERSIBLE ELECTRIC LOCOMOTIVE

Filed July 20, 1926 3 Sheets-Sheet 3

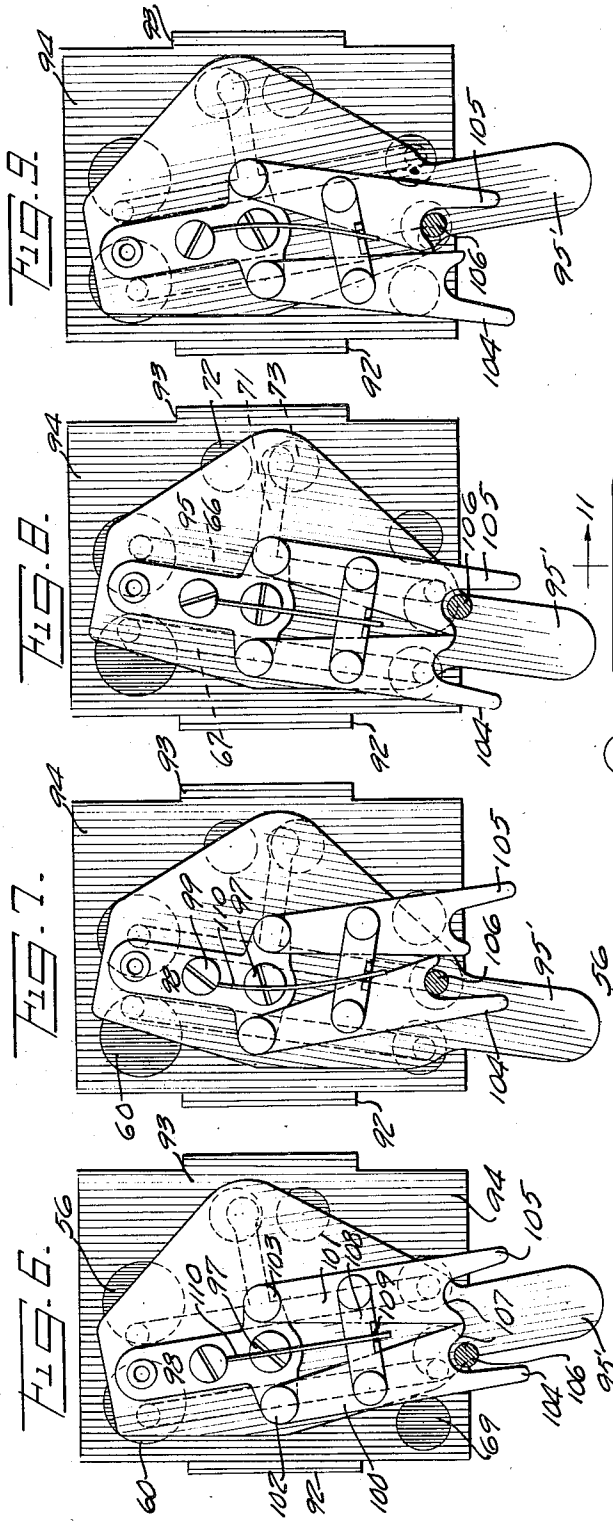

Fig. 9.

Fig. 8.

Fig. 7.

Fig. 6.

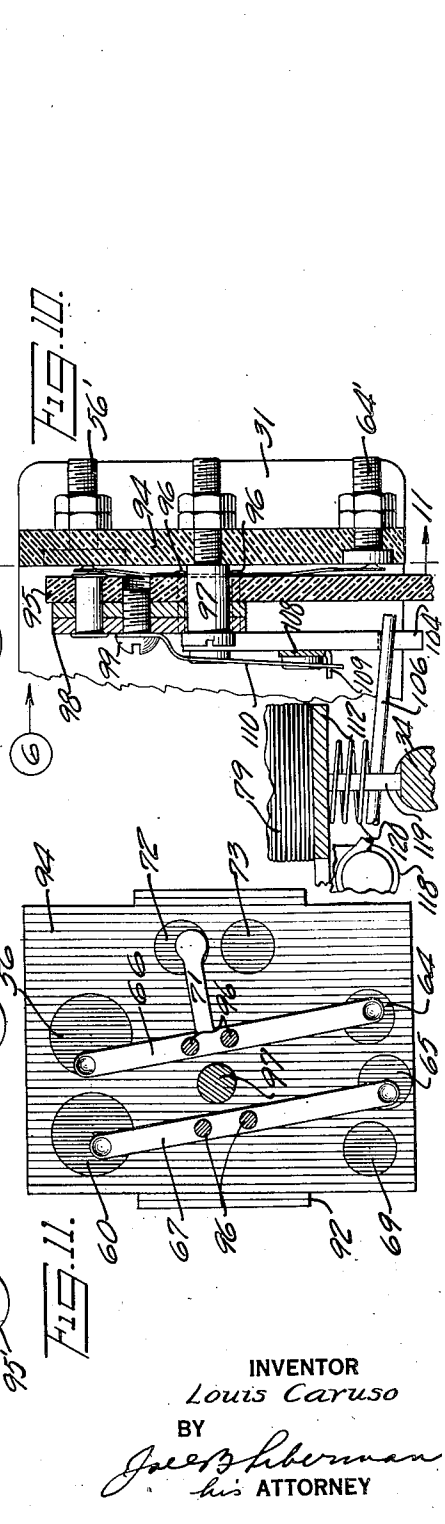

Fig. 10.

Fig. 11.

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Patented June 24, 1930 1,766,329

UNITED STATES PATENT OFFICE

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REVERSIBLE ELECTRIC LOCOMOTIVE

Application filed July 20, 1926. Serial No. 123,684.

The present invention relates to a reversible electric locomotive which is more particularly adapted for use in toy railways.

Toy electric railroads, as ordinarily constructed, are made up of a track lay-out composed of a plurality of interchangeable sections of track. These sections may be straight or curved and the lay-out may include switches, crossings, and other sections simulating corresponding parts of steam and electric railroads. Each of the sections includes an insulated or third rail and two outside or track rails which are generally considered to be the grounded side of the system. These track rails may or may not be insulated from one another. The third rail and the track rail or rails are connected to the source of power by a pair of wires and a switch. The current is collected by a brush riding on the third rail and passes through the motor to the grounded running gear. Where alternating current is available, the source of power is generally in the form of a transformer which supplies current at a reduced potential from the lighting mains. Where direct current is supplied, however, it is customary to provide a rheostat, known in the trade as a current reducer.

Inasmuch as these systems ordinarily have but two wires leading from the power supply to the tracks, it is necessary to provide the moving locomotive with whatever reversing mechanism that is to be employed, relying upon a switch in the power supply line merely for the purpose of starting and stopping the train. Its speed may be determined by the setting of the transformer or the current reducer, depending on which of these is used.

Manually operable reversing switches on a locomotive have been in common use for many years, and various attempts have been made to reverse the locomotive automatically employing mechanisms carried by the locomotive. These mechanisms, however, have generally included an electromagnetically operated switch or controller, whose coil is in circuit all the time that the locomotive is being operated. With this coil in circuit all the time, it is necessary in its design to provide for the dissipation of the heat generated in it. It has been especially difficult in practice to operate locomotives on direct current where such a controller was employed, for the reason that such a coil consumes an amount of current which overloads the rheostat, or current reducer. The increased load makes it impossible to economically get sufficient current through the current reducer to satisfactorily supply the motor with current.

The present invention contemplates a reversible electric locomotive wherein the motor may be reversed by the operation of a simple make and break switch in the power supply leading to the track lay-out, and in which the electrical parts of the reverse operating mechanism do not draw current during the operation of the propelling motor. By so constructing the locomotive one may readily reverse the locomotive in the desired manner, and overheating of coils on the locomotive, and the drawing of excessive current through the transformer or current reducer is avoided.

The invention furthermore contemplates the use of an electro-magnetically operated reversing switch for the motor, which switch may be energized only under certain circumstances, and which is de-energized when the propelling motor is in operation. The foregoing object may be suitably accomplished by controlling the operating coil of the reversing switch by an auxiliary switch which operates in a more sluggish manner so that the circuit for the coil of the reversing switch is opened immediately after it has functioned. In carrying out this invention, it has been found that the sluggish control for the quick acting reversing switch may take the form of a normally-closed circuit maker placed so as to be operated by the stray field from the propelling motor. A movable armature located adjacent the field structure may normally close the circuit for the coil of the reversing switch and this armature may be moved when the stray field is set up about the motor, the parts being so arranged that the reversing switch operates to throw the contact before the stray field has completed

the movement of this armature. With this arrangement, the field controlled armature will hold the contacts separated as long as the motor is in operation. As soon as the motor stops, the circuit maker is closed so that the reversing switch will be operated when the circuit is restored.

Certain toy railway systems have insulated sections of power or track rail so that the locomotive may be stopped or again started automatically or otherwise. Where a reversible locomotive of the nature above referred to is to be used in such a system, the train would be started backward instead of forward when the power supply was restored. Since, under certain circumstances in operating toy railways, it may be undesirable to have the locomotive reverse each time the power is connected to it, the present invention contemplates the provision of means for disabling the actuating devices for the reversing switch. According to the present embodiments of the invention, the circuit for the reversing switch operating coil is opened by a device preferably so arranged that it is accessible for manual operation, but is not likely to be accidentally operated. According to the preferred embodiment of the invention, the field controlled armature is moved to a position to open the circuit of the operating coil of the reversing switch.

A further object of the invention is to provide manually operable means for actuating the reversing switch so that the motor may be reversed even though the automatic reversing mechanism is disabled, either intentionally or through accident.

In the manufacture of toy locomotives of the type in which the present invention may be embodied, the power plant, including the motor, the wheels and current collector, is assembled as a complete unit or chassis before being placed in the locomotive frame. For purposes of easy assembly and test, the present invention preferably contemplates the mounting of the reversing switch and its controls on or in this unit. According to the preferable construction, a subframe is provided which may be mounted in the chassis frame. This subframe carries the reversing switch, its operating coil and connections, as well as the field controlled armature and contact and all the wiring for the motor and controls may be supported by the chassis.

Toy electric locomotives are generally provided with two headlights and the present invention also contemplates the interconnecting of these headlights with the reversing switch so that a particular headlight is operated according to the position of the reversing switch.

Another object of the invention is to provide a simple and effective reversing switch, which may be operated by the movement of an electromagnetically operated plunger in one direction only, and which stays in the place to which it has been moved when the plunger is restored to the other position.

Other and further objects of the invention will appear as the description proceeds.

The accompanying drawings show, for purposes of illustrating the invention, one of the many possible embodiments in which it may take form, it being understood that the drawings are illustrative of the invention which is not limited to the same.

In these drawings:

Figure 1 is a side elevational view, with parts broken away and parts in section, showing a toy locomotive equipped with an embodiment of the present reversing mechanism;

Figure 2 is a circuit diagram;

Figure 3 is a perspective view showing the subframe, carrying the reversing switch, its actuating means, and the field controlled contact;

Figure 4 is a top plan view showing the power plant and chassis of the locomotive with the reversing mechanism in place;

Figure 5 is a section taken on the line 5—5 of Figure 4, parts being omitted;

Figure 5[a] is a fragmentary view of a modification;

Figure 6 is a view taken in the direction of arrows 6 of Figures 4, 5 and 10 showing the reversing switch and operating parts in one position, the subframe for supporting the switch being omitted;

Figures 7 to 9, inclusive, are views similar to Figure 6 showing the reversing switch in the other positions of its cycle of operation;

Figure 10 is a vertical sectional view through the reversing switch; and

Figure 11 is a sectional view taken on the line 11—11 of Figure 10.

The body of the locomotive is here indicated in the form of a sheet metal stamping 15 and sheet metal roof or cover 16 arranged, shaped and ornamented to give the locomotive the appearance of a miniature locomotive. The power plant, including the driving wheels, gears and chassis, is suitably mounted in this main frame so that the locomotive body will be carried from the chassis. For convenience of disclosure, the present drawings show a common form of locomotive construction in which the chassis is made up in the form of flat sheet metal steel plates 17 and 18 permanently secured together by cross pieces 18′ as usual. A pair of axles 19 and 20 are mounted in these plates to carry the locomotive drivers 21. The armature shaft 22 is also mounted in these side plates or frames and, through the usual reduction gearing 23, operates the locomotive drive wheels 21. The laminated field structure 24 is fastened to the plate 18, while the brushes 25 and 26 are carried by a brush rigging such as shown in Patent No. 1,536,329, mounted on

the opposite side plates 17. The current collecting rollers 27 adapted to ride on the third rail, are also carried in the lower part of the chassis. The plates 17 and 18 and the motor armature, motor field, brush rigging and power drive from the armature shaft to the wheels may follow standard and accepted forms and constructions, and, according to the preferred embodiment of the invention, no changes whatever are necessary except to provide for mounting the reversing control in the chassis.

As contemplated by the present invention, all the parts of this reversing control are preferably mounted on a subframe 29, as shown in Figures 3, 4 and 5. This subframe has side members 30 and 31 which preferably take the form of rigid flat metal stampings. These subframe members 30 and 31 are suitably fastened together by distance pieces 32, 33 and 34, held in place by screws or rivets, so as to provide a rigid frame work for supporting the parts. As here shown, the plate 31 is provided with tapped holes 35 and 36 so that the subframe may be fastened in place in the main chassis frame as by screws, one of which is indicated at 37. This subframe carries a reversing switch, indicated generally by the reference character 38, and shown in detail in Figures 6 to 10 inclusive, a solenoid coil and operating connections between the coil and the reversing switch for mechanically operating the same, these parts being indicated generally by the reference character 39, and a normally closed circuit controlling device adjacent the motor field, generally indicated by the reference character 40. The detailed construction of these parts will be set forth later.

In Figure 2, showing the circuit diagram, the two track rails are indicated at 50 and 51 and the central insulated or third rail at 52. The system is connected with suitable power supply which may be a current reducer, transformer or battery, as indicated at 53, and the supply of power to the track layout may be controlled by a switch 54.

The current collector 27 on the toy locomotive is connected by a lead 55 to a fixed contact 56 in the reversing switch 38 above referred to. The field coil 57 of the motor is grounded at one side 58 to the motor frame or field structure 24 and thence to the track rails in the ordinary manner. The other side of the motor field 57 is connected by a wire lead 59 to another contact 60 of the reversing switch. The circuit from the motor armature 61 includes leads 62 and 63 which are connected with stationary contacts 64 and 65 respectively, of the reversing switch. The movable contacts of the reversing switch include strips 66 and 67 indicated in dotted lines in the circuit diagram which strips are mounted to move about a pivot indicated by circle 68. An additional contact 69 is connected with the fixed contact 64 by a strip indicated at 70.

By simultaneously moving the connecting strips 66 and 67 from the dotted line position to bring the lower ends of these contacts onto fixed contacts 65 and 69, the upper ends of the strips are not moved off their contacts and the circuit connections for the armature will be reversed. The detailed construction of this switch will be described later.

The movable contact strip 66 is provided with an arm 71 adapted to sweep across fixed contacts 72 and 73 so as to connect one or the other of these contacts into the circuit. The contact 72 is connected through a suitable lead 74 with a headlight 75 which is grounded to the frame of the locomotive, while the other contact 73 is connected with a lead 76 with a second headlight 77. These headlights are on the opposite ends of the locomotive and it will be obvious that the actuation of the reversing switch will disconnect one headlight and connect the other in circuit. Instead of using two headlights, one could use a headlight and a tail light to show a danger signal to the rear of the backwardly moving train.

A solenoid coil 79 forming part of the reversing switch operating mechanism 39 is connected by a lead 80 with the fixed terminal 56. This coil is also connected by a lead 81 with a fixed contact 82 against which a movable armature 83 normally rests. This contact and armature form the normally closed circuit controlling device 40. This armature is placed adjacent the field structure 24 of the motor and is so arranged that the circuit between the parts 82 and 83 may be opened and closed, thereby connecting the solenoid coil into the circuit when the field is de-energized and disconnecting it from the circuit when the stray field of the motor is set up. The fixed contacts of the reversing switch 38 are all mounted on an insulating block 94 (preferably molded in place in bakelite or the like,) while the movable contact strips are mounted on an insulating sheet or block 95. The fixed block 94 is provided with lugs 92 and 93 and is mounted in slots 90 in the plates 30 and 31 of the subframe 29.

In Figures 6 to 11 inclusive, where the details of the switch are shown, the fixed and movable contacts are given the same reference characters as in the circuit diagram.

The insulating block 94 is preferably made of a piece of moulded material such as bakelite and each of the contacts referred to in the description in the circuit diagram is mounted in this insulating body and is connected with a binding post carried on the opposite side. These binding posts are provided for connecting the wires. The binding posts are indicated by the same reference characters as the contacts with a prime (′) added.

The movable contact strips 66 and 67 are

mounted on an insulating plate 95 by means of rivets 96. This contact carrying member 95 is pivotally mounted on the stud 97 so that it can be moved back and forth so that the movable contacts pass over the fixed contacts and change the circuits as desired.

A T-shaped metal bearing member 98 is fixedly mounted on the inside of the movable insulating plate by a screw 99 and pivot stud 97. A pair of links 100 and 101 are pivotally mounted at the ends of this T-shaped member as shown at 102 and 103. The lower ends of these links are provided with ears 104 and 105 extending below an operating arm 106 which is moved up and down by the solenoid 79. These ears are placed on the remote side of the links as indicated and the links are, if desired, provided with pockets 107 into which the arm 106 is carried as it is lifted upwardly, the pocket being entered depending upon the position of the switch. The links 101 and 102 are connected by a cross link 108 which is provided with an apertured lug 109, and a wire spring 110 passes through this aperture and is secured under the head of the screw 99 as indicated in Figure 10. The lower end of the movable contact carrying member 95 extends below the stationary insulating block 94 to provide a finger grip as indicated at 95'. This finger piece is accessible from underneath the locomotive so that one can reach in with the finger and move the reversing switch back and forth, as desired.

The solenoid coil 79 is wound about a spool and is carried on a magnetic pole piece 111 attached to an upper steel cross piece 113. The lower end of the spool is supported in a lower piece 112 made of brass. The upper cross piece 113 extends beyond the subframe member 31 as indicated at 114 so as to fit into slots 115 in the side pieces of the locomotive chassis frame, thereby definitely placing the subframe in the chassis frame and improving the magnetic field of the coil 79. The lower cross piece 112 has lugs 116 which extend into slots in the subframe members 30 and 31. The cross piece 112 is also provided with an extension 117 which is carried back toward the field of the motor and which is provided with a downwardly bent ear 118 to provide a pivotal support for the switch operating arm 106. This switch operating arm passes through the magnetic plunger 119 carried inside the solenoid coil 79. A coil spring 120 pushes the plunger downward and holds it against the cross piece 34 when the coil is de-energized. An insulating cross piece 121 is placed above the coil 79 to provide an insulating support for the wire of the coil and the terminal for fastening the solenoid lead.

As above referred to, the subframe 29 also carries the movable armature responsive to the stray field of the motor. Such movable armature is indicated in the drawings at 130 as being pivoted at 131 in the subframes 30 and 31 adjacent the motor field 24. The end 132 of the armature is considerably heavier than the end adjacent the motor field so that the armature normally rests in the full line position in Figure 2 and in the dotted line position of Figure 5. The armature is of course grounded to the frame. The end adjacent the motor field is preferably provided with a silver contact 133 which may be in the form of a rivet, the under side of the rivet 134 preventing the iron of the armature from contacting with the field structure 24 of the motor. The contact 133 on the field armature is normally engaged with a contact 135 carried on the end of a spring 136, the spring being pivotally mounted on an insulating cross piece 137 carried by the subframe. For simplicity, this spring contact is indicated by the reference character 82 in Figure 2. The spring contact 136 is comparatively flexible and the contact and armature are preferably arranged so that the spring is normally bent upwardly an appreciable amount by the armature. This permits the spring to follow the armature down as it is attracted toward the field of the motor for purposes to be described.

As above indicated, there are certain circumstances under which it is desirable to separate the armature from the spring contact so as to open the control circuit for the automatic electromagnetic reversing switch operating device. As shown in Figure 5, a lever 138 is pivoted at 139 in the side frames 30 and 31. This lever carries an extension 140 which is underneath the end 132 of the armature. The lower end 141 of the lever extends below the motor armature so as to be accessible from underneath the locomotive. The lever 138 also carries a lug 142 which moves back and forth between stops or abutments 143 and 144 on the subframe member 31. A spring 145 is carried by the subframe member 31 and cooperates with the lever 138 to hold it in one or the other of its extreme positions. When the lever 138 is moved from the full line position of Figure 5 to the dotted line position, the armature is freed so that it can move under the influence of gravity and the motor field. When the lever is in the full line position, the armature is locked and the circuit opened.

A modified form of construction for moving the armature 83 away from the spring contact is shown in Figure 5a. Here a flat lever 138' is pivoted at 139' in the subframe 30. The lower end 141' of this lever is accessible for operation while the other end 140 engages with the armature. Spring 145' holds the lever in one position or the other, as desired.

The operation

It is assumed that a locomotive provided

with the reversing switch and operating means above described is properly placed above the track and the parts are in the normal position for utilizing the reverse operating mechanism. As far as the locomotive is concerned, the branches of the circuit will be closed through the motor field and armature, one headlight and the solenoid coil 79. It is also assumed that the reversing switch is in the position shown in Figures 2 and 6 and that the motor is to be started by closing the main switch 54 to apply power to the track. As soon as the switch 54 is closed the circuit is completed through the air core solenoid coil 79 and this coil will immediately attract the plunger thereby operating the lever 106 to the position of Figure 7. This movement takes place very quickly and in much less time than is required for the motor field to build up and attract the armature 132 sufficiently to operate it from the contact 135. The contact 135 is, as above mentioned, carried on the end of the spring 136 which is bent upwardly to a slight extent when the field controlled armature is released from the field. During a portion of the time the motor field is moving the armature, this spring contact follows the armature a short distance and thereby maintains the circuit in the coil 79 for sufficient time to insure operation of the reversing switch. This reversing switch operates so quickly, however, that the motor armature does not move until after the reversing switch has operated, to change the connections between the field and armature, so that, when the armature does move, it goes in the direction opposite to that in which it has been running. As soon as the motor field is established, the armature 132 is attracted to the full line position of Figure 5 to separate it from the spring contact 136. The stray field of the motor will hold the armature in place as long as the field is energized. Hence the armature for the switch operating coil 179 will be opened thereby permitting the lever 106 to move into the position shown in Figure 8 which releases the links 100 and 101 permitting them to be moved by the spring 110 to the position of Figure 8. The movement of the reversing switch will also disconnect one headlight and connect the other one in circuit.

The motor will then operate in the desired direction until the main supply circuit is again broken. As soon as the motor field is de-energized, the armature 132 moves back against the spring contact 135 and establishes the circuit for the solenoid coil 79. The next time that the circuit is closed, the reversing switch will be again actuated moving the parts from the position shown in Figure 8 to the position of Figure 9 and then to the position of Figure 6 so as to turn the reversing switch to the original position and open the circuit for coil 79.

It has been found in practice that the functioning of the coil 79 of the reversing switch is exceedingly rapid and that the locomotive starts in the desired direction without noticeable delay.

When one desires to disable the automatic reversing switch, this can readily be accomplished by reaching underneath the locomotive with the finger and moving the lever 141 from the dotted line position to the full line position of Figure 5, thereby permitting opening the circuit for the control coil 79, the motor may then be reversed by manually throwing the reversing switch from one position to the other.

A standard locomotive in which the reversing has heretofore been done by a manually operated switch, can be changed over to the automatic reversing locomotive by inserting the subframe and parts carried thereby. One such subframe is shown for the purpose of illustration in the present drawings.

By providing suitable means for disconnecting the operating coil of the reversing switch, it is possible to design an operating coil without considering the heat losses generated in it. By removing this coil from the circuit while the locomotive is in operation, it is also possible to greatly improve the operation of the locomotive over what it would be were the coil in circuit, for the added current taken by such a coil increases the line losses and reduces the potential available for the motor. Where direct current is used in a circuit such as indicated, the disconnecting of the coil 79 relieves the current reducer from this load, and of course reduces the amount of heat which develops in the current reducer, as well as permitting more propulsion current to be drawn from the power source.

It will of course be understood that various other forms of reversing switch and operating means may be used, and that various other arrangements may be provided for automatically connecting and disconnecting the switch operating coil at the proper time so as to keep it out of circuit while the motor is in operation.

It is obvious that the invention may be embodied in many forms and constructions, and I wish it to be understood that the particular form shown is but one of the many forms. Various modifications and changes being possible, I do not limit myself in any way with respect thereto.

What is claimed is:

1. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of

rotation of the motor, electromagnetic means for actuating the reversing switch, and a normally closed circuit controlling device in circuit with the electromagnetic means, said circuit controlling device remaining closed for a sufficient time after the closing of the main switch to permit the electromagnetic means to actuate the reversing switch and then being opened and held open by the stray field of the motor.

2. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch, a normally closed circuit controlling device in circuit with the electromagnetic means, said circuit controlling device remaining closed for a sufficient time after the closing of the main switch to permit the electromagnetic means to actuate the reversing switch and then being opened and held open by the stray field of the motor and a manually operable device for holding the circuit controlling device open.

3. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch, and a normally closed circuit controlling device in circuit with the electromagnetic means, said circuit controlling device remaining closed for a sufficient time after the closing of the main switch to permit the electromagnetic means to actuate the reversing switch and including an armature movably mounted in a position to be influenced by the stray field of the motor for opening the circuit.

4. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch, a normally closed circuit controlling device in circuit with the electromagnetic means, said circuit controlling device remaining closed for a sufficient time after the closing of the main switch to permit the electromagnetic means to actuate the reversing switch and including an armature movably mounted in a position to be influenced by the stray field of the motor for opening the circuit, and a manually operable device for holding the armature in open circuit position.

5. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, said means including a solenoid coil, and a normally-closed motor controlled circuit controlling device in circuit with the coil, said circuit controller device being automatically opened by the motor when it is in operation.

6. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, said means functioning in less time than is required for the motor armature to move, and a normally-closed circuit controlling device in circuit with the electromagnetic means, said device opening when the motor field is established.

7. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, and a device responsive to the establishing of the stray field of the motor for disconnecting the electromagnetic means, said device requiring more time to function than is required for the actuation of the reversing switch.

8. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, said means including a coil connected to one side of the circuit, and a movable armature connected to the other side of the circuit and responsive to the establishing of the stray field of the motor for opening the circuit to disconnect the electromagnetic means, said armature requiring more time to open the circuit than is required for the actuation of the reversing switch.

9. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between

the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, said means including a coil connected to one side of the circuit, a movable armature connected to the other side of the circuit and responsive to the establishing of the stray field of the motor for opening the circuit to disconnect the electromagnetic means, said armature requiring more time to open the circuit than is required for the actuation of the reversing switch, and a manually operable device for holding the armature in open circuit position.

10. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, a fixed contact connected to the coil of said electromagnetic means, and a movable armature disposed in the stray field of the motor and normally in contact with the fixed contact, said armature being responsive to the establishing of the stray field to disconnect the electromagnetic means, said movable armature requiring more time to open the circuit than is required for the actuation of the reversing switch.

11. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, and a device responsive to the establishing of the stray field of the motor for disconnecting the electromagnetic means, said device requiring more time to function than is required for the actuation of the reversing switch, the position of the reversing switch being unaffected by the disconnecting of said electromagnetic means.

12. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor for actuating the reversing switch including a solenoid controlled plunger operable upon the closing of the main switch, a device responsive to the establishing of the stray field of the motor for disconnecting the solenoid, said device requiring more time to function than is required for the actuation of the reversing switch, and a spring to restore the plunger to normal position when the solenoid is deenergized.

13. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch, a normally closed circuit controlling device in circuit with the electromagnetic means, said circuit controlling device remaining closed for a sufficient time after the closing of the main switch to permit the electromagnetic means to actuate the reversing switch and then being opened and held open by the stray field of the motor, and a manually operable device for actuating the reversing switch independently.

14. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch, a normally closed circuit controlling device in circuit with the electromagnetic means, said circuit controlling device remaining closed for a sufficient time after the closing of the main switch to permit the electromagnetic means to actuate the reversing switch and including an armature movably mounted in a position to be influenced by the stray field of the motor for opening the circuit, and a manually operable device for actuating the reversing switch independently.

15. A system for controlling electric motors, comprising, motor leads connectible to a power source through a main switch, a reversing switch, interconnections between the reversing switch and the motor field and the motor armature for reversing the direction of rotation of the motor, electromagnetic means for actuating the reversing switch upon the closing of the main switch, said means including a coil connected to one side of the circuit, a movable armature connected to the other side of the circuit and responsive to the establishing of the stray field of the motor for opening the circuit to disconnect the electromagnetic means, said armature requiring more time to open the circuit than is required for the actuation of the reversing switch and a manually operable device for actuating the reversing switch independently.

16. In combination, a toy track lay-out provided with two track rails and a third rail insulated from the track rails, a power source connected through a main switch to the third

rail and to the track rails, a locomotive having running gear on the track rails and a current collector contacting with the third rail, a propulsion motor and reversing means therefor connected between the running gear and the current collector, actuating means for the reversing switch responsive to the closing of the main switch, and motor controlled means to de-energize the actuating means while the propulsion motor is running.

17. In combination, a toy track lay-out provided with two track rails and a third rail insulated from the track rails, a power source connected through a main switch to the third rail and to the track rails, a locomotive having running gear on the track rails and a current collector contacting with the third rail, a propulsion motor and reversing switch therefor connected between the running gear and the current collector, and actuating means for the reversing switch including a plunger normally held in one position and movable to another position by a solenoid coil connected in parallel with the motor, said connections including a normally closed contact which is opened when the field of the motor is established.

18. In combination, a toy track lay-out provided with two track rails and a third rail insulated from the track rails, a power source connected through a main switch to the third rail and to the track rails, a locomotive having running gear on the track rails and a current collector contacting with the third rail, a propulsion motor and reversing switch therefor connected between the running gear and the current collector, actuating means for the reversing switch including a plunger normally held in one position and movable to another position by a solenoid coil connected in parallel with the motor, said connections including a normally closed contact which is opened when the field of the motor is established, and a manually operable device for holding the normally closed contact open.

19. In combination, a toy track lay-out provided with two track rails and a third rail insulated from the track rails, a power source connected through a main switch to the third rail and to the track rails, a locomotive having running gear on the track rails and a current collector contacting with the third rail, a propulsion motor and reversing switch therefor connected between the running gear and the current collector, an electromagnet having an armature operable to shift the reversing switch when energized, and electrical connections for the electromagnet including a normally closed contact which opens when the motor is energized.

20. A toy electric locomotive having a current collector, a grounded frame, a motor and reversing switch therefor connected between the frame and current collector, and actuating means for the reversing switch including a magnet coil connected between the frame and current collector, said connections including a pair of normally closed contacts which open when the motor is operated.

21. A toy electric locomotive having a current collector, a grounded frame, a motor and reversing switch therefor connected between the frame and current collector, actuating means for the reversing switch including a magnet coil connected between the frame and current collector through a pair of normally closed contacts, and means operated by the stray field of the motor for opening said contacts subsequent to the actuation of the reversing switch.

22. A toy electric locomotive having a current collector, a grounded frame, a motor and reversing switch therefor connected between the frame and current collector, actuating means for the reversing switch including a magnet coil connected between the frame and current collector, said connections including a pair of normally closed contacts, and means for opening said contacts which means functions in response to the energization of the motor and more sluggishly than the magnet coil.

23. In a toy railroad, a toy electric locomotive having grounded running gear mounted on toy railroad tracks and a current collector contacting with an insulated third rail, and a main switch controlling the application of power to the tracks, the locomotive being provided with a motor and a motor reversing switch connected between the running gear and current collector, and electromagnetic means for operating the reversing switch connected in parallel with the motor and switch, said connections including a switch which opens to de-energize the electromagnet after it has functioned to operate the reversing switch, said last mentioned switch being held open as long as the motor is energized and closing when the motor is de-energized.

24. The combination with a toy electric locomotive having a chassis on which is mounted the field, armature and brush rigging of the propulsion motor, the current collector, the running gear and power driving connections, of a subframe mounted on the chassis, a reversing switch, an electromagnetic actuating means for the reversing switch, both of which are carried by the subframe, and connections between the reversing switch, the current collector and the motor for reversing the motor.

25. The combination with a toy electric locomotive having a chassis on which is mounted the field, armature and brush rigging of the propulsion motor, the current collector, the running gear and power driving connections, of a subframe mounted on the chassis, a reversing switch, an electromag-

netic actuating means for the reversing switch, both of which are carried by the subframe, said actuating means including a solenoid coil and connections which move the reversing switch when the coil is energized, the de-energizing of the coil permitting the connections to return to normal position without affecting the reversing switch, and connections between the reversing switch, the current collector and the motor for reversing the motor.

26. The combination with a toy electric locomotive having a chassis on which is mounted the field, armature and brush rigging of the propulsion motor, the current collector, the running gear and power driving connections, of a subframe mounted on the chassis, a reversing switch, an electromagnetic actuating means for the reversing switch, both of which are carried by the subframe, a movable armature and a cooperative contact both carried by the subframe, the armature being in a position to be affected by the stray field of the motor to separate it from the contact, connections between the reversing switch, the current collector and the motor for reversing the motor, and connections between the contact and the actuating means to de-energize the same while the motor field is energized.

27. The combination with a toy electric locomotive having a chassis on which is mounted the field, armature and brush rigging of the propulsion motor, the current collector, the running gear and power driving connections, of a subframe mounted on the chassis, a reversing switch, an electromagnetic actuating means for the reversing switch, both of which are carried by the subframe, said actuating means including a solenoid coil and connections which move the reversing switch when the coil is energized, the de-energizing of the coil permitting the connections to return to normal position without affecting the reversing switch, a movable armature and a cooperative contact both carried by the subframe, the armature being in a position to be affected by the stray field of the motor to separate it from the contact, connections between the reversing switch, the current collector and the motor for reversing the motor, and connections between the contact and the actuating means to de-energize the same while the motor field is energized.

28. The combination with a toy electric locomotive having a chassis on which is mounted the field, armature and brush rigging of the propulsion motor, the current collector, the running gear and power driving connections, of a subframe mounted on the chassis, a reversing switch, an electromagnetic actuating means for the reversing switch, both of which are carried by the subframe, a device also carried by the subframe and responsive to the establishing of the stray field of the motor for opening the circuit of the electromagnetic actuating means, and connections between the reversing switch, the current collector and the motor for reversing the motor.

29. The combination with a toy electric locomotive having a chassis on which is mounted the field, armature and brush rigging of the propulsion motor, the current collector, the running gear and power driving connections, of a subframe mounted on the chassis, a reversing switch, a solenoid coil and actuating means for the reversing switch, an armature movably mounted on the subframe and normally spaced from the motor field in circuit with the solenoid coil and an electric contact normally in engagement with said armature, the armature being attracted toward the field to open the circuit when the motor field is energized, all of said parts being carried by the subframe, and connections between the reversing switch, the current collector and the motor for reversing the motor.

30. In combination, an electric motor having a field structure, a movably mounted armature normally spaced from the motor field structure, and electric contact normally in circuit-closing engagement with said armature, the armature being attracted toward the field to open the circuit when the motor field is energized, and a device for moving the armature to open circuit position and holding it there.

31. In combination, an electric motor having a field structure, a movably mounted armature normally spaced from the motor field structure, and a resilient electric contact normally in circuit-closing engagement with said armature, the armature being attracted toward the field to open the circuit when the motor field is energized, the resilient contact moving with the armature to slightly delay the opening of the contact.

32. In combination, an electric motor having a field structure, a movably mounted armature normally spaced from the motor field structure, and a resilient electric contact normally in engagement with said armature, a motor reversing switch having an electromagnetic operating means in series with the contact, the armature being attracted toward the field to open the circuit when the motor field is energized, the resilient contact moving with the armature to slightly delay the opening of the circuit of the switch operating means.

33. The method of controlling the propulsion motor of a toy electric locomotive, comprising, electromagnetically operating a locomotive supported reversing switch in the motor circuit in response to the application of potential to the terminals of the locomotive to effect a reversal of the motor, and utilizing the stray field of the motor for subsequently disconnecting the electromagnetic operator

while the locomotive is running and without affecting the motor circuit.

34. The method of controlling the propulsion motor of a toy electric locomotive, comprising, electro-magnetically operating a locomotive supported reversing switch in the motor circuit in response to the application of potential to the terminals of the locomotive to effect a reversal of the motor, and utilizing the stray field of the motor for subsequently disconnecting the electromagnetic operator while the locomotive is running and without affecting the motor circuit, the connections for the electromagnetic operator being reestablished when the motor supply circuit is opened.

35. The method of controlling the propulsion motor of a toy electric locomotive, comprising, electro-magnetically operating a locomotive supported reversing switch in the motor circuit in response to the application of potential to the terminals of the locomotive to effect a reversal of the motor before the motor armature has moved the locomotive, and disconnecting the electromagnetic operator as soon as the motor field is established to prevent re-energizing the electromagnetic operator until the motor is disconnected from the power supply.

36. The method of disconnecting the operating means for a reversing switch for an electric motor which consists in causing an armature in the stray field of the motor to be moved to open the circuit of the operating means.

37. The method of reversing the direction of operation of an electric motor which consists in partially completing the circuit for a reversing switch operating means in response to the disappearance of the stray field of the motor when it is disconnected from the power source, completing said circuit by connecting the power source to the motor to cause the operation of the reversing switch and thereafter utilizing the stray field of the motor for opening the circuit of the said means and holding it open while the motor is connected to the power source.

38. In a toy electric railway locomotive a motor frame comprising spaced side plates rigidly secured together, and an electric motor supported between said plates, said plates providing a reversing switch space between them, and an electric reversing switch unit including side plates rigidly secured together by means of cross-bars and cross-plates said side plates so spaced as to have an outside width dimension smaller than the space between said motor frame plates, and reversing switch means permanently supported between said unit side plates, said unit adapted to be inserted as an entity in said space within the frame, and screws rigidly securing said motor side plates to the side plates of said unit.

39. In a toy electric railway locomotive, a motor frame having an electric motor supported therein and having a reversing switch space, and an electric reversing switch unit including spaced side plates rigidly secured together in spaced relation by means of cross pieces, and reversing switch means permanently supported between said plates, said unit adapted to be inserted as an entity in said space, and means removably securing said unit to said motor frame.

Signed at Irvington, in the county of Essex, and State of New Jersey, this 14th day of July, 1926.

LOUIS CARUSO.