June 24, 1930. M. CARUSO 1,766,600

LOCOMOTIVE REVERSING SWITCH

Filed Dec. 23, 1926 2 Sheets-Sheet 1

FIG. 1

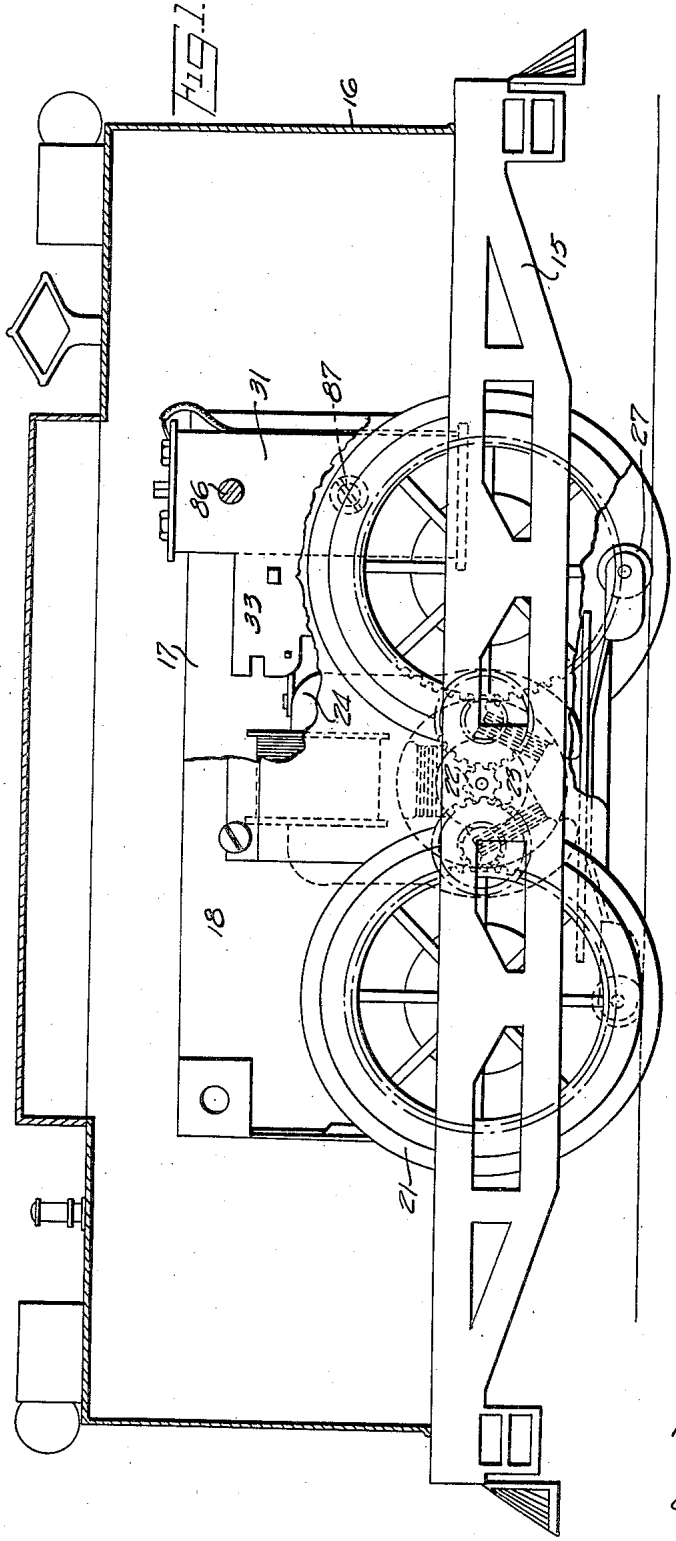
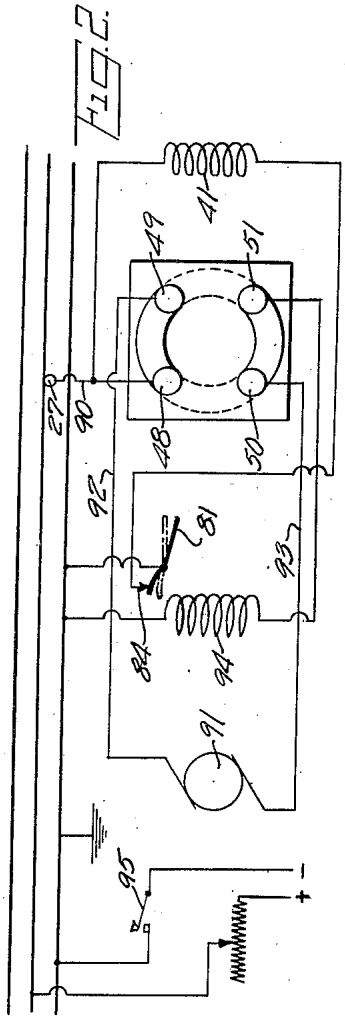


FIG. 2



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LOCOMOTIVE REVERSING SWITCH

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FIG. 3.

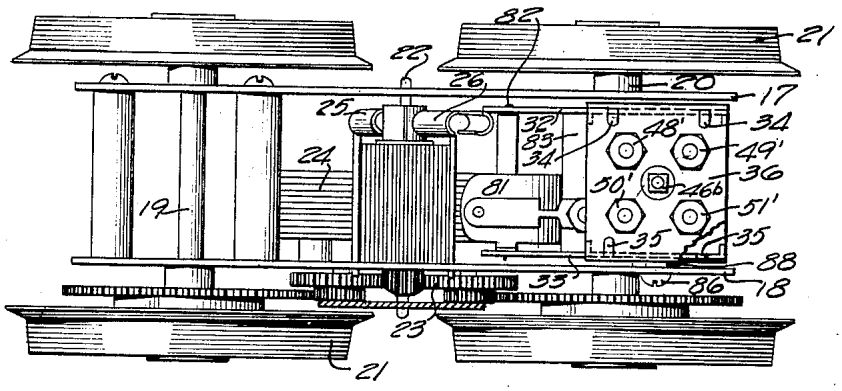


FIG. 4.

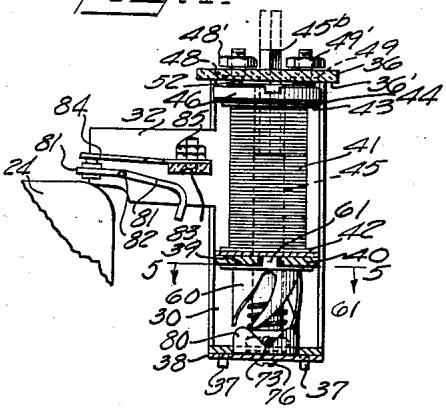


FIG. 5.

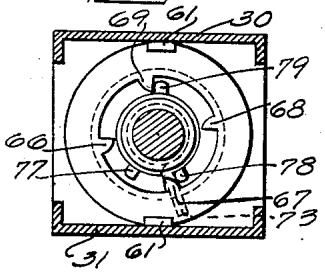


FIG. 6.

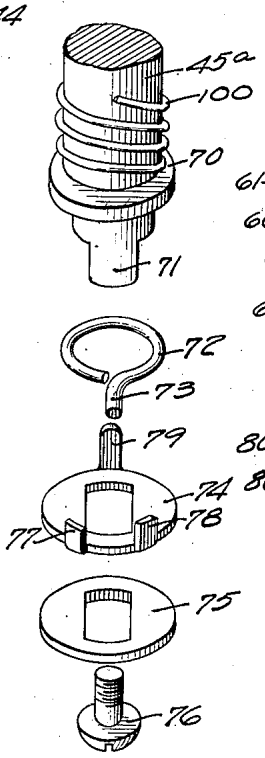
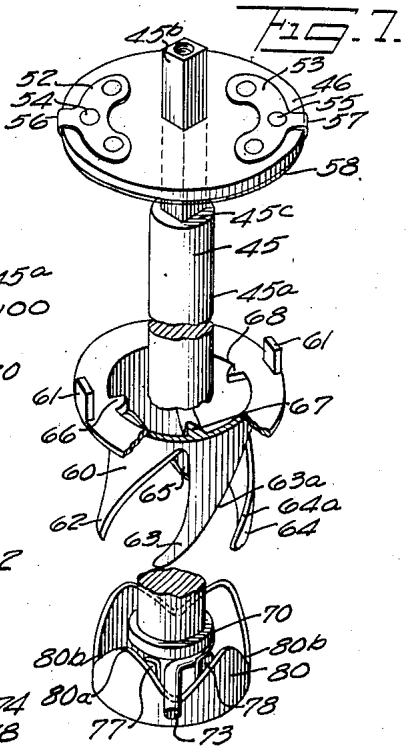


FIG. 7.



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Patented June 24, 1930

1,766,600

UNITED STATES PATENT OFFICE

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LOCOMOTIVE REVERSING SWITCH

Application filed December 23, 1926. Serial No. 156,561.

The present invention relates to locomotive reversing switches and is more particularly directed toward an electromagnetic switch and controls suitable for use in reversing toy electric locomotives.

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 locomotives. 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 reversing switch and associated parts suitable for use on a toy locomotive and is so constructed that it may function to reverse the circuit in the locomotive whenever the power supply circuit leading to the track lay-out is opened and then closed.

An object of the present invention is to provide a reversing switch and electromagnetic means for operating the same, combined with a make and break switch for controlling the electromagnetic means, all of which are mounted on a subframe which may be carried in a toy locomotive adjacent the field structure of the motor. According to the preferred embodiment of the invention, a rotary switch member is used which is moved angularly when the electromagnet is energized to attract its armature and wherein the return movement of the structure of the armature is accomplished without moving the rotary contact.

A further object of the invention is to provide an electromagnetically operated switch wherein the armature is normally

held in one position when the magnet coil is de-energized and is moved bodily to another position and turned angularly on the energization of the magnet coil, the return of the armature to normal position being effected without rotary movement.

A further object of the invention is to provide a reversing switch and cooperable fixed and rotary movable contacts operable by an electromagnet wherein the parts are so arranged that the magnet shifts the movable contacts to change circuit connections without leaving these connections in open circuit at the end of the functioning of the magnet.

The present invention relates to switches for use in reversible electric locomotives of the general type shown in the application of Louis Caruso, Serial No. 123,684, filed July 20, 1926.

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

The accompanying drawings show, for purposes of illustration, one of the many possible embodiments of the present invention, it being understood that the drawings are illustrative rather than limiting 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 the present reversing mechanism;

Figure 2 is a circuit diagram;

Figure 3 is a top plan view of the power plant of the locomotive showing the reversing switch installed therein;

Figure 4 is a sectional view taken on the line 4—4 of Figure 3;

Figure 5 is a horizontal sectional view taken on the line 5—5 of Figure 4;

Figure 6 is a perspective view of the lower end of the movable plunger and parts carried thereby; and

Figure 7 is a perspective view showing parts of the plunger and the cam control.

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 and a pair of axles 19 and 20 mounted in these plates 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, the reversing switch and its controls are preferably carried on a subframe which is mounted in the main frame of the locomotive. As here shown this subframe has two side channel shaped side plates or members 30 and 31 which may be made of magnetic material and have laterally extending arms 32 and 33. The upper ends of these channel shaped subframe members are provided with prongs 34 and 35 which pass upwardly through an insulating block 36 which are bent over onto the block to lock it in place as indicated in Figure 3. The lower ends of the side frame members are provided with prongs 37 which pass through a cross piece 38 and are bent over against it. The subframe is further stiffened by iron cross pieces 39 and 40 placed below the middle or center of the frame. A solenoid coil 41 is carried on a spool whose ends 42 and 43 are held in place by cross pieces 39, 40 and 44. A plunger 45 is carried inside the coil. The lower part 45^a of this plunger is magnetic, while the upper part 45^b may be made of brass and as here shown is of square cross section. An insulating disk 46 is mounted on the square portion of the plunger and is carried between the cross piece 44 and the insulating contact carrier 36.

The contact carrier 36 is provided with four fixed contacts or buttons 48, 49, 50 and 51 attached to binding posts 48′, 49′, 50′ and 51′, as indicated. The contact buttons are carried on the lower face 36′ of the contact carrier and are arranged to cooperate with arc-shaped contact strips 52 and 53 carried on the upper face of the insulating disk 46. These contact strips 52 and 53 are riveted to the disk as shown at 54 and 55 and have prongs 56 and 57 which pass down around the outside of the disk to secure the contacts in place. A thin sheet of insulation 58 is provided to insulate these prongs from the cross piece 44 of the subframe. The movable contacts exert a slight spring pressure on the fixed contacts and are so arranged that a quarter turn of the movable contact carrier will move these contacts from

one set of fixed contacts to another set of fixed contacts, thereby reversing the motor connections, as will be pointed out below.

A cylindrical cam member 60 is mounted underneath the cross pieces 39 and 40, prongs 61 being used to align the cam member relative to the fixed contacts. This cam member as here shown has four depending curved prongs 62, 63, 64 and 65. It also has four stop members 66, 67, 68 and 69. The lower part of the plunger 45[a] extends down through the inside of the cylindrical cam as indicated. It is here shown as being provided with a collar 70 and a non-circular lower end portion 71. A ring 72 having a projecting arm 73 is carried directly underneath this collar 70 and is loosely held in place by a washer 74 non-rotatably clamped in place in the lower end of the plunger by means of a washer 75 and screw 76. The washer 74 is provided with two upwardly bent prongs 77 and 78 between which the arm 73 projects. The washer 74 is also provided with an upwardly projecting prong 79 which passes outside the ring 72 to cooperate with the stop members 66 to 69, inclusive.

A second circular cam member 80 is mounted on the lower cross member 38 of the subframe and is placed directly underneath the plunger. This cam member is here shown as being provided with four hills and valleys 80[a] and 80[b], and of such a diameter that the arm 73 at all times extends beyond the outside of the cam. This cam acts as a positioning device to reset the arm 73.

The lateral extensions 32 and 33 on the subframe members carry an armature member 81 pivoted at 82 so as to be in the stray field of the motor. These extensions also carry an insulated cross piece 83 on which is mounted a spring contact member 84 which extends over above the movable armature and normally is in engagement therewith.

The subframe carrying the field controlled armature contact and the electromagnetically operated reversing switch may be mounted in the proper position in the main frame of the toy locomotive. As here shown this mounting is accomplished by two screws 86 and 87 passed through the side frame member 18 and threaded into the subframe member 31, suitable distance pieces 88 and 89 being provided to align the parts.

Referring now to Figure 2 which shows the circuit diagram, it will be seen that the third rail contact shoe 27 is connected by a wire 90 with the binding post 48′ connected to the fixed contact 48. The armature 91 of the motor is connected by leads 92 and 93 with the binding posts 49′ and 50′ while the motor field coil 94 is connected to the other fixed contact 51 and is grounded to the frame of the motor in the usual fashion. The solenoid coil 41 is connected to the power supply binding posts 48′ and to binding post 85 and thence to the spring contact 84. When the armature 81 is in the position indicated in Figure 4, the coil 41 will be grounded through the contact 84 and armature 81 to the frame of the motor.

The operation

Assuming that the locomotive has been assembled as above described and is placed on the track in the customary manner, it will be controlled by opening and closing the main control switch 95, placed in the power supply circuit in the customary manner. Upon closing of the switch 95, current will flow through the solenoid coil 41, contact 84, armature 81 to the grounded side of the motor. The circuit through the solenoid coil is maintained for a short period during the time in which the motor field is attracting the field controlled armature 81. To insure that the circuit is maintained, it is preferable to make the contact 84 somewhat flexible so that it is bent slightly upward when the field controlled armature is held against it by gravity. The coil 41 quickly raises the plunger. During this movement, the arm 73 will be brought first against the lower cam face 63[a] thereby swinging the ring 72 and arm to bring the arm against the projection 78. Upon further upward movement of the plunger, the arm 73 will be carried along the cam face 63[a] and will therefore compel the plunger to move angularly. The limit of the angular movement is controlled by the engagement of the prong 79 with the corresponding stop member such as 67 as indicated in Figure 5. The vertical movement of the plunger may be limited by the engagement of the upper end 45[b] of the magnetic part of the plunger with the cross piece 36. During this upward movement of the plunger, it will have turned through 90° and will have changed the circuit connections so as to reverse the armature relative to the field as will be obvious from the circuit diagram.

As soon as the stray field of the motor has been built up and the armature has been moved to separate it from the spring 84, the circuit from the coil 41 will have been opened. It will therefore drop the plunger to its former position, this action being insured by providing a small coiled spring 100 placed above the collar 70. As the plunger drops, the arm 73 will be carried down along the upper side of the cam member 64.

As will be obvious from the shape of these cam members, it will be apparent that the arm 73 will be moved slightly backward toward the stop 77 so as to permit the parts to drop free. As soon as the arm 73 has

dropped past the lower end of the cam member 60, it will engage with the upper edge of the cam member 80 which will swing it to the position indicated in Figures 4 and 7, thereby moving it beyond the toe of the respective cam member to reset it for the next succeeding actuation of the plunger by the coil. The arm 73 will then be underneath the next prong so as to repeat the operation of stepping the plunger and the rotatable parts as the magnetic coil is energized.

It is obvious that the invention may be embodied in many forms and construction, 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. An electromagnetic switch comprising, a solenoid coil, a plunger normally held in one position and axially movable to another position upon energization of the coil, a plurality of stationary contacts, an insulating disk carrying a plurality of contacts arranged to change circuit connections with the fixed contacts upon rotation of the disk, the plunger having a slidable nonrotatable connection with the disk, and means to advance the plunger a partial revolution upon energization of the coil.

2. An electromagnetic switch comprising, a solenoid coil, a plunger normally held in one position and axially movable to another position upon energization of the coil, a plurality of stationary contacts, an insulating disk carrying a plurality of contacts arranged to change circuit connections with the fixed contacts upon rotation of the disk, the plunger having a slidable nonrotatable connection with the disk, and a cam mechanism for advancing the plunger a partial revolution upon energization of the coil.

3. An electromagnetic switch comprising, a solenoid coil, a plunger normally held in one position and axially movable to another position upon energization of the coil, a plurality of stationary contacts, an insulating disk carrying a plurality of contacts arranged to change circuit connections with the fixed contacts upon rotation of the disk, the plunger having a slidable nonrotatable connection with the disk, a stationary cam member, and an arm carried by the plunger and cooperative with the cam for advancing the plunger a partial revolution upon energization of the coil.

4. An electromagnetic switch comprising a solenoid coil, a plunger normally held in one position and axially movable to another position upon energization of the coil, a plurality of stationary contacts, an insulating disk carrying a plurality of contacts arranged to change circuit connections with the fixed contacts upon rotation of the disk, the plunger having a slidable non-rotatable connection with the disk, a stationary cam member, an arm carried by the plunger and cooperative with the cam for advancing the plunger a partial revolution upon energization of the coil, the arm having a limited freedom of movement about the plunger, and a stationary positioning device for predetermining the position of the cam when the coil is de-energized.

5. An electromagnetic switch comprising, a solenoid coil, a plunger normally held in one position and axially movable to another position upon energization of the coil, a plurality of stationary contacts, an insulating disk carrying a plurality of contacts arranged to change circuit connections with the fixed contacts upon rotation of the disk, the plunger having a slidable non-rotatable connection with the disk, means to advance the plunger a partial revolution upon energization of the soil, and stops to determine the extent of rotary movement of the plunger.

6. An electromagnetic switch comprising, a solenoid coil, a plunger normally held in one position and axially movable to another position upon energization of the coil, a plurality of stationary contacts, an insulating disk carrying a plurality of contacts arranged to change circuit connections with the fixed contacts upon rotation of the disk, the plunger having a slidable non-rotatable connection with the disk, a stationary cam member, an arm carried by the plunger and cooperative with the cam for advancing the plunger a partial revolution upon energization of the coil, the arm having a limited freedom of movement about the plunger, a stationary positioning device for predetermining the position of the cam when the coil is de-energized, and stops to determine the extent of rotary movement of the plunger.

7. In an electromagnetic switch, a magnet coil, a plunger axially movable along the coil and rotatably mounted therein, fixed contacts, cooperative movable contacts coupled to the plunger for angular movement therewith, means to angularly move the plunger step by step each time the plunger is attracted by the coil, said means comprising a fixed cylindrical cam member having a plurality of prongs disposed about the plunger, an arm carried by the plunger and engageable with the prongs to angularly move the plunger, the arm having a limited freedom of movement about the plunger, and a stationary positioning device for predetermining the position of the arm when the coil is de-energized.

8. In an electromagnetic switch, a magnet coil, a plunger axially movable along the coil and rotatably mounted therein, fixed contacts, cooperative movable contacts

coupled to the plunger for angular movement therewith, means to angularly move the plunger step by step each time the plunger is attracted by the coil, said means comprising a fixed cylindrical cam member having a plurality of prongs disposed about the plunger, and an arm carried by the plunger and engageable with the prongs to angularly move the plunger, the arm having a limited freedom of movement about the plunger, the prongs on the cam being so shaped that the arm is moved slightly backward when the plunger is released by the coil, and a stationary positioning device for advancing the arm to place it in position to engage the next prong when the coil is again energized.

9. In an electromagnetic switch, a magnet coil, a plunger axially movable along the coil and rotatably mounted therein, fixed contacts, cooperative movable contacts coupled to the plunger for angular movement therewith, and means to angularly move the plunger step by step each time the plunger is attracted by the coil, said means including a stop member carried by the plunger and a plurality of stationary cooperative stop members to limit the angular movement of the plunger.

10. In an electromagnetic switch, a magnet coil, a plunger axially movable along the coil and rotatably mounted therein, fixed contacts, cooperative movable contacts coupled to the plunger for angular movement therewith, means to angularly move the plunger step by step each time the plunger is attracted by the coil, said means comprising a fixed cylindrical cam member having a plurality of prongs disposed about the plunger, an arm carried by the plunger and engageable with the prongs to angularly move the plunger, a stop member carried by the plunger and a plurality of stationary cooperative stop members to limit the angular movement of the plunger.

11. In an electromagnetic switch, a magnet coil, a plunger axially movable along the coil and rotatably mounted therein, fixed contacts, cooperative movable contacts coupled to the plunger for angular movement therewith, means to angularly move the plunger step by step each time the plunger is attracted by the coil, said means comprising a fixed cylindrical cam member having a plurality of prongs disposed about the plunger, an arm carried by the plunger and engageable with the prongs to angularly move the plunger, a stop member carried by the plunger a plurality of stationary cooperative stop members to limit the angular movement of the plunger the arm having a limited freedom of movement about the plunger, the prongs on the cam being so shaped that the arm is moved slightly backward when the plunger is released by the coil, and a stationary positioning device for advancing the arm to place it in position to engage the next prong when the coil is again energized.

12. A locomotive reversing switch comprising a subframe adapted to be mounted in a toy electric locomotive adjacent the motor of the locomotive, a movable armature supported by the subframe adjacent the field structure so as to be influenced by the stray field of the motor, a magnet coil carried by the subframe, a contact cooperable with the movable armature to open and close the circuit of the magnet coil, a plunger in the magnet coil, a circuit reversing switch having cooperative fixed contacts carried by the subframe and movable contacts operably connected to the plunger, and means to move the plunger and contacts a partial revolution when the magnet coil attracts the plunger.

13. A locomotive reversing switch comprising a subframe adapted to be mounted in a toy electric locomotive adjacent the motor of the locomotive, a movable armature supported by the subframe adjacent the field structure so as to be influenced by the stray field of the motor, a magnet coil carried by the subframe, a contact cooperable with the movable armature to open and close the circuit of the magnet coil, a plunger in the magnet coil, a circuit reversing switch having cooperative fixed contacts carried by the subframe and movable contacts operably connected to the plunger, and means to move the plunger and contacts a partial revolution when the magnet coil attracts the plunger, the plunger returning to its normal position under the influence of gravity without angularly moving the contacts.

14. A locomotive reversing switch comprising a subframe adapted to be mounted in a toy electric locomotive adjacent the motor of the locomotive, a movable armature supported by the subframe adjacent the field structure so as to be influenced by the stray field of the motor, a magnet coil carried by the subframe, a contact cooperable with the movable armature to open and close the circuit of the magnet coil, a plunger in the magnet coil, a circuit reversing switch having cooperative fixed contacts carried by the subframe and movable contacts operably connected to the plunger, the contacts being placed above the coil, and means to move the plunger and contacts a partial revolution when the magnet coil attracts the plunger, said means including cam mechanism cooperable with the lower end of the plunger.

15. A locomotive reversing switch comprising a subframe adapted to be mounted in a toy electric locomotive adjacent the motor of the locomotive, a movable armature supported by the subframe adjacent the field structure so as to be influenced by the stray

field of the motor, a magnet coil carried by the subframe, a contact cooperable with the movable armature to open and close the circuit of the magnet coil, a plunger in the magnet coil, a circuit reversing switch having cooperative fixed contacts carried by the subframe and movable contacts operably connected to the plunger, the contacts being placed above the coil, and means to move the plunger and contacts a partial revolution when the magnet coil attracts the plunger, said means including cam mechanism cooperable with the lower end of the plunger, the plunger dropping free of the cam mechanism and being automatically reset when the coil circuit is opened.

16. A locomotive reversing switch comprising a subframe adapted to be mounted in a toy electric locomotive adjacent the motor of the locomotive, a movable armature supported by the subframe adjacent the field structure so as to be influenced by the stray field of the motor, a magnet coil carried by the subframe, a contact cooperable with the movable armature to open and close the circuit of the magnet coil, a plunger in the magnet coil, a circuit reversing switch having cooperative fixed contacts carried by the subframe and movable contacts operably connected to the plunger, and means to move the plunger and contacts a partial revolution when the magnet coil attracts the plunger, said means including an arm laterally projecting from the plunger and having limited angular movement relative thereto, fixed cams for engaging the arm to cause the plunger to move angularly when the coil is energized, and means to reset the arm when the coil is de-energized.

17. A locomotive reversing switch comprising a subframe having side members, a plurality of fixed contacts insulatively supported between the side members, a rotatable contact carrier provided with a pair of contacts cooperable with the fixed contacts, an axially movable magnet plunger normally held in one extreme position and non-rotatably connected with the contact carrier, a solenoid coil carried between the side frames for moving the plunger to the other position, and means for angularly moving the plunger and contacts when the coil moves the plunger.

18. A locomotive reversing switch comprising a subframe having side members, a plurality of fixed contacts insulatively supported between the side members, a rotatable contact carrier provided with a pair of contacts cooperable with the fixed contacts, an axially movable magnet plunger normally held in one extreme position and non-rotatably connected with the contact carrier, a solenoid coil carried between the side frames for moving the plunger to the other position, means for angularly moving the plunger and contacts when the coil moves the plunger, laterally extending arms on the side frames, and a normally closed circuit controlling switch for the magnet coil supported on said arms, the switch including a movable armature adapted to be held open by the stray field of the locomotive.

Signed at Naples, Italy, this 4th day of December, 1926.

MARIO CARUSO.