Sept. 30, 1941. E. E. McKEIGE ET AL 2,257,473

REMOTE CONTROL SYSTEM FOR TOYS

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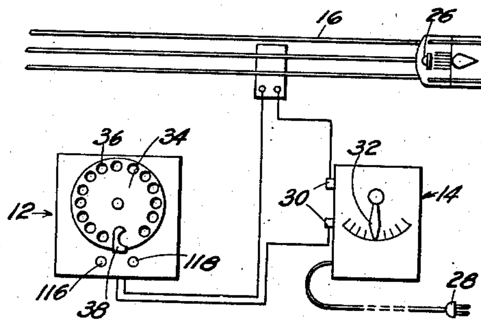
FIG. 1.



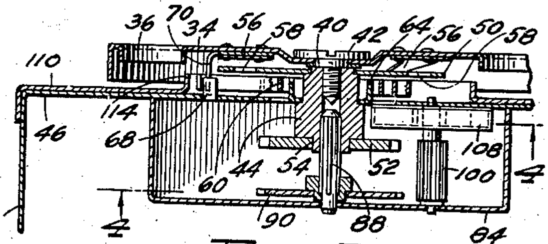


FIG. 3.

FIG. 2.

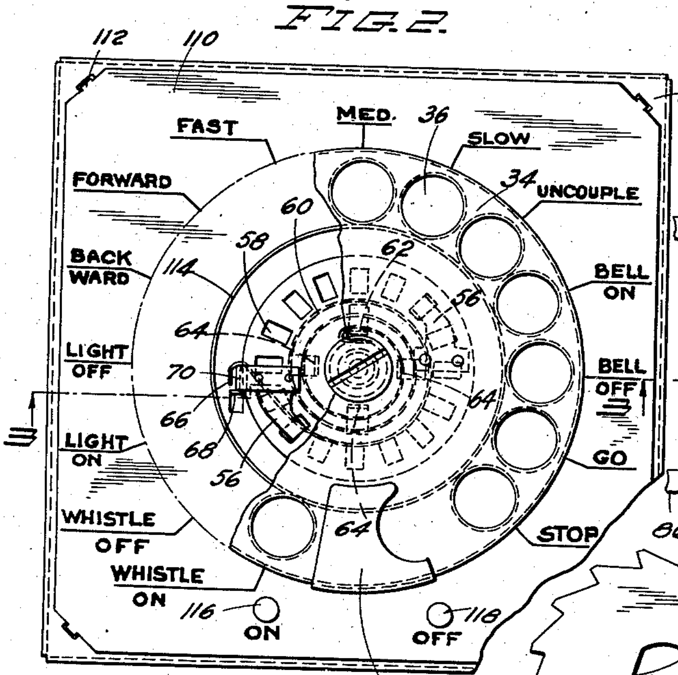
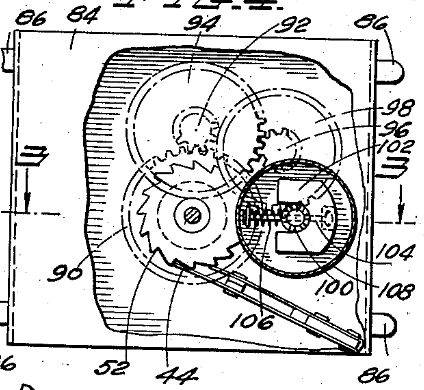


FIG. 4.



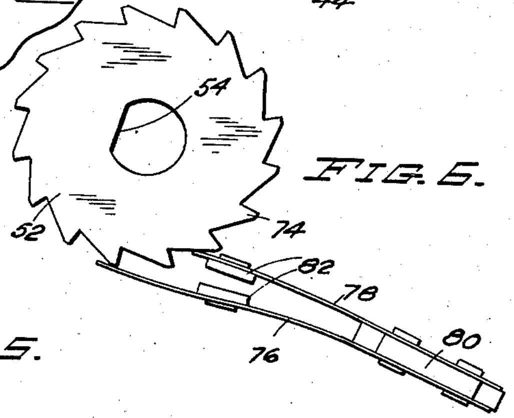


FIG. 6.

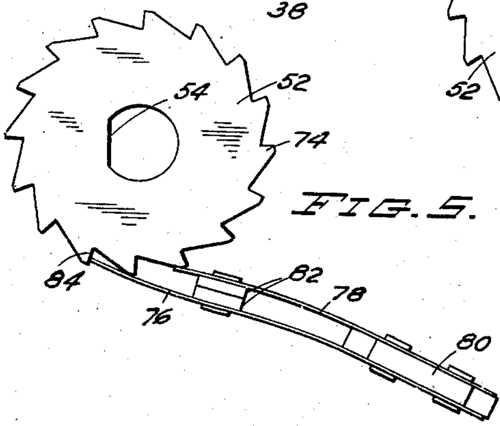


FIG. 5.

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FIG. 8.

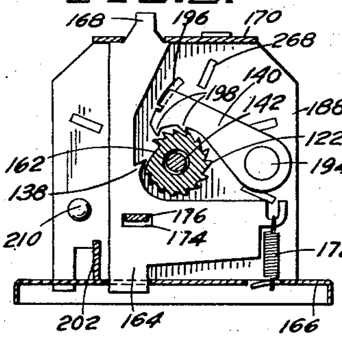


FIG. 7.

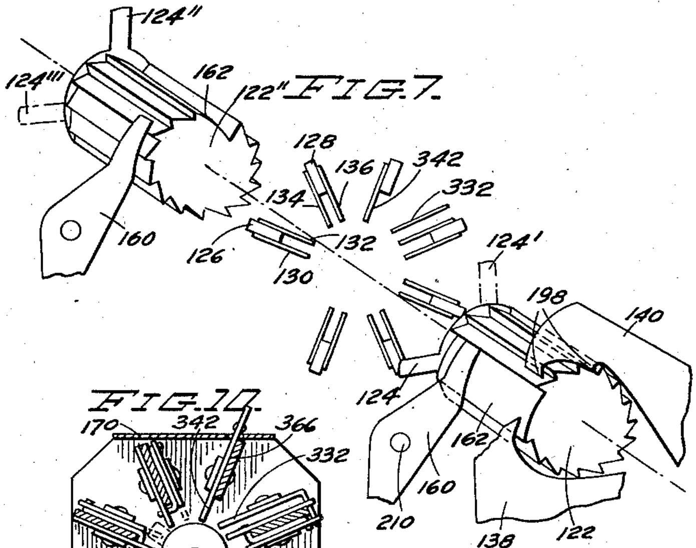


FIG. 9.

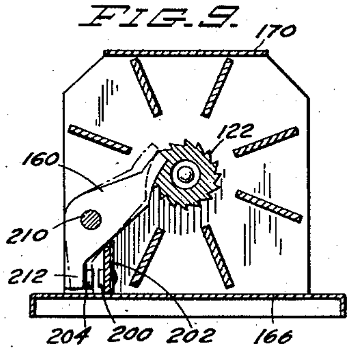


FIG. 10.

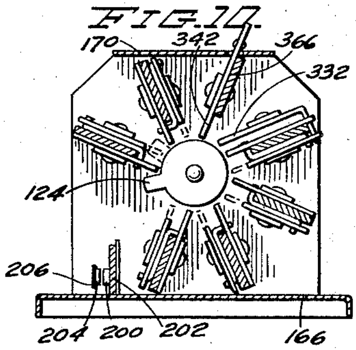


FIG. 11.

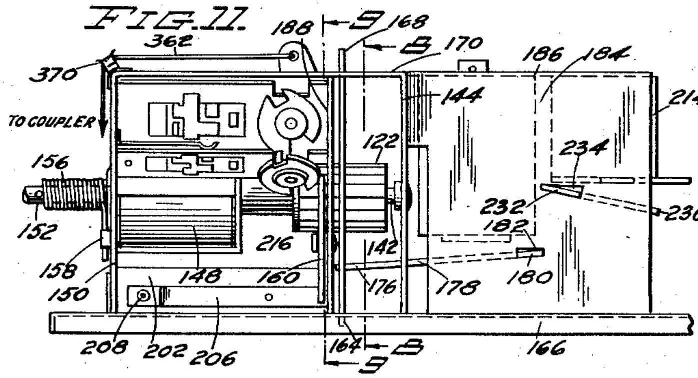


FIG. 12.

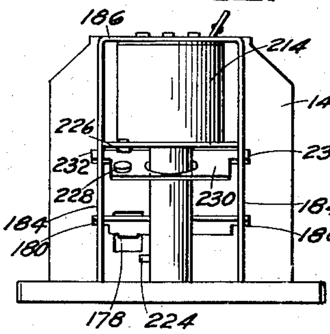
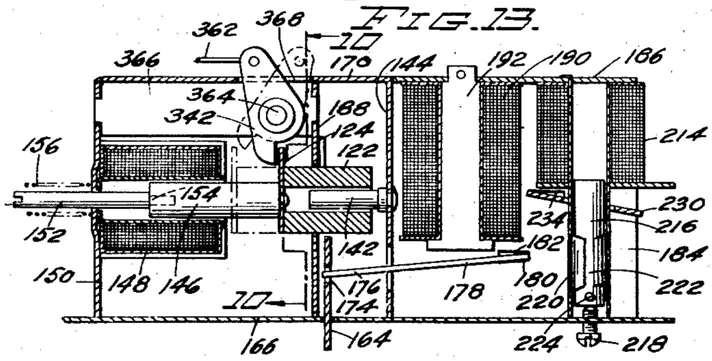


FIG. 13.



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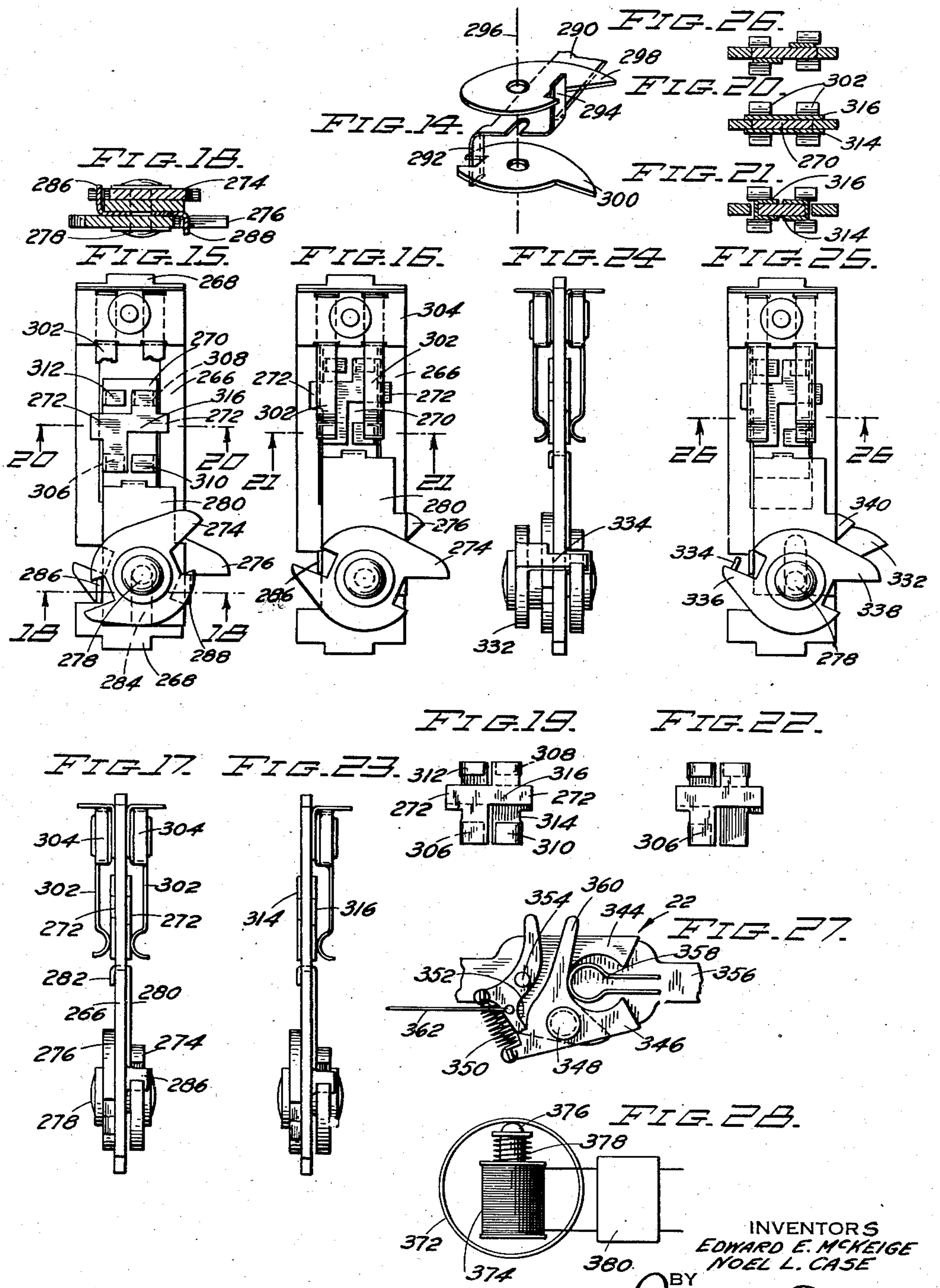

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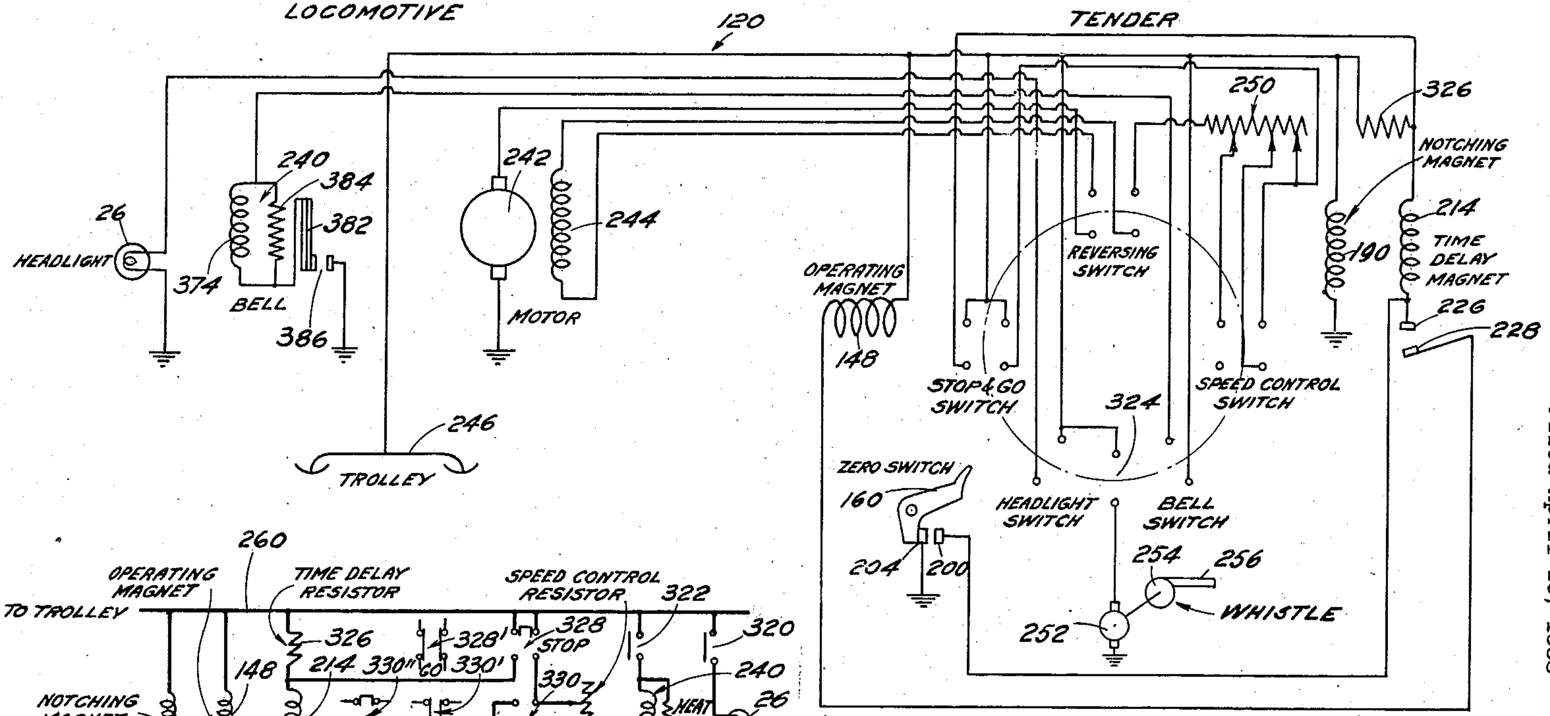

FIG. 29.

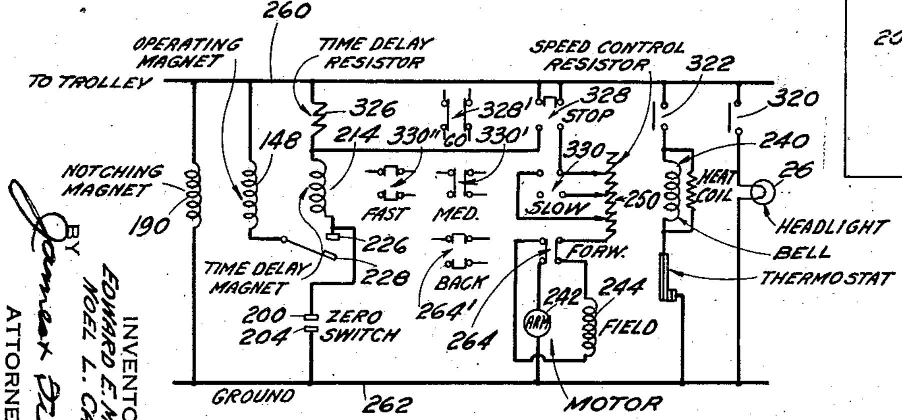

FIG. 30.

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Patented Sept. 30, 1941 2,257,473

UNITED STATES PATENT OFFICE

2,257,473

REMOTE CONTROL SYSTEM FOR TOYS

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Application April 15, 1938, Serial No. 202,187

28 Claims. (Cl. 104—150)

This invention relates to a remote control system for controlling a plurality of operations in a toy and relates more particularly to a dial type remote control system for toy trains.

The primary object of the present invention is to generally improve remote control systems for toys, especially toy trains or other vehicles running on a track and energized through an insulated rail or trolley system. A more particular object is to control a plurality of operations on the train or vehicle through the regular propulsion current of the vehicle, or, in other words, through a simple two-wire feed system leading to the toy and without necessitating extra control wires or extra control currents of differentiated character. For example, there is no superposition of direct current on alternating current, or vice versa, and the regular propulsion current is the only current that is used for signalling.

A more particularized object of the present invention resides in the provision of remotely controlled train-carried coupling means. For this purpose, the coupler is provided with a latch holding it in locked condition, and there is a train-carried means, preferably an electrically-operated means, such as a magnet, for releasing the latch and thereby opening the coupler. The magnet is controlled by a train-carried switch, and that is remotely controllable from a stationary trackside remote control transmission device. In this way, the coupling means may be opened at will at any point around the track system.

Still another object is to provide for speed control mechanism on the train itself, said mechanism being remotely controlled from a stationary trackside transmitter. In the specific form here illustrated, the train carries a speed regulating resistor and a speed control switch having low, medium and high speed positions for cutting in or out a desired amount of the resistor. This train-carried switch is remotely controlled from the trackside transmitter, and thus the speed of the train may be varied by a controller on the train itself, much as in a real train, and without any variation in the voltage applied to the track system from the step-down transformer or other source of current. This has manifest advantages, for lights and signals on the train, and various trackside signals and accessories may all be energized at substantially constant voltage instead of being dimmed when the train is run at low speed. Moreover, in connection with the present invention, there is the advantage that the remote control system itself operates under a steady, predetermined voltage.

Other objects of the invention are to provide, in a generally analogous way, for remote control of other operations on the train. Specifically, the lighting system on the train may be controlled by a train-carried switch which is itself remotely controllable from the trackside transmitter. So, also, the train may be provided with an audible signal, such as a bell or a whistle, or both, and these may be energized by circuits including train-carried switches which are remotely controllable from the trackside transmitter.

A further object of our invention is to arrange for remote control of the operation and the direction of operation of the vehicle, and with this object in view, the driving motor has appropriate switches associated with it and said switches are arranged for remote control from the trackside transmitter, thus making it possible to stop, or start, or reverse the train at will.

The provision of suitable means for any one of the foregoing functions might not be an excessively difficult matter, but, in accordance with a further and most important feature of our invention, we make it possible to control all of the foregoing functions, or any desired combination of a lesser number or greater number of functions, while maintaining the control of each of the functions wholly independent of the others, so that the desired train operations may be obtained in any desired sequence and at any desired time intervals.

Still further objects of the invention center about the provision of specific preferred apparatus for the purposes heretofore outlined. In general, the apparatus comprises a trackside transmitter and a train-carried receiver. In accordance with the present invention, the transmitter is made of the dial type and comprises a rotatable dial with finger-holes somewhat like a telephone dial, but the dial holes correspond to different train functions and are appropriately marked for that purpose. The dial controls an interrupter cam which causes spaced interruptions in the supply of propulsion current to the track, and these interruptions may be considered to be the control impulses which are sent out from the transmitter to the receiver. In accordance with more detailed features and objects of the present invention, the impulses are transmitted at a uniform rate of speed by causing the dial to function during its return or restoring movement, the latter being accomplished by a spring which is wound up during the digital operation of the dial. Moreover, the transmitter may be and preferably is provided with a train of step-up gearing and a governor driven thereby in order to regulate the speed of impulse transmission.

Further objects of the invention center about a preferred construction for the train-carried receiver. We provide a toothed movable control member, a notching magnet, a notching pawl operated by the magnet for moving the control member tooth by tooth to a selected control position, depending upon the number of impulses applied to the notching magnet. We further provide operating means causing the control member to function in order to effect a control operation dependent upon the selected position of the control member, and we combine with this a delay means to prevent functioning of the operating means during the transmission of notching impulses. More specifically, the control member is a rotatable and axially movable toothed drum carrying an operating finger. The notching pawl rotates the drum to bring the finger to a selected position, and an operating solenoid, which functions after the notching operation, moves the drum and operating finger axially past a series of control devices disposed radially about the drum, said finger operating the selected one of the control devices.

The control devices are preferably switches, and these are to be shifted to one position or another and there left until changed by another and different control operation. In accordance with the present disclosure, each switch comprises a frame, with a slider shiftable thereon, and spring contacts secured to the frame and bearing against the slider. A plurality of oscillatable cams are secured on opposite sides of the frame, and are connected to the slider by means including a lug or pin on one side cooperating with one cam, and a lug or pin on the other side, cooperating with the other cam, said lugs being on opposite sides of the axis of the cams, so that movement of one cam moves the slider in one direction and, at the same time, moves the other cam in opposite direction. The axially movable operating finger on the aforedescribed toothed drum bears against and moves one or another of the cams, and, in this way, shifts the switch. A plurality of these switches are disposed radially about the drum, as was previously described.

It has already been mentioned that the operating solenoid, which shifts the drum axially after it has been notched, to align it with the proper switch, should not function until after the series of notching impulses has been transmitted. A further object of the present invention is to provide suitable delay means for preventing premature energization of the operating solenoid. For this purpose, we provide a delay solenoid disposed with its axis vertical and having its plunger below said solenoid so far as to slow up the plunger response. We provide contacts which are closed by the plunger only after the plunger has been elevated all the way into the delay solenoid. The plunger is unable to reach the necessary elevation, in response to the short pulses of current, during the dialing operation, but after completion of the dialing operation, when a steady flow of current is re-established, the plunger is elevated and the contacts are closed. These contacts are in series with the operating solenoid and thus cause the desired axial operating movement.

A further object of the present invention is to deenergize the operating solenoid and the delay magnet so that they will not function during normal operation of the train between dialing operations. For this purpose, we provide what may, for convenience, be termed a "zero switch," this switch being in series with either, and preferably both the operating solenoid and delay solenoid, and being so arranged that it is open when the drum is restored to initial or zero position, but is closed the moment the drum begins to rotate, as during a dialing operation.

Still another object of the invention is to provide for restoration of the drum to initial position after completion of a dialing operation. For this purpose, the drum is provided with suitable means, for example, a spring, for urging the drum axially to initial position and rotatably to zero position. The drum is rotated by a notching pawl, as previously described, and is held by a detent, but both the notching pawl and detent are so located on the drum that when the drum moves axially far enough to shift the selected switch, it also moves beyond and free of said pawl and detent, and is thereupon free to rotate back to zero position. In zero position, the aforesaid zero switch is opened, thus deenergizing the operating solenoid, and the drum is thus freed to move axially back to initial position.

To the accomplishment of the foregoing and other objects which will hereinafter appear, our invention consists in the remote control elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a plan view schematically illustrating the invention as applied to a dial type remote control train system;

Fig. 2 is a plan view of the dial transmitter with a part of the dial cut away;

Fig. 3 is a section taken in elevation through the transmitter;

Fig. 4 is a partially sectioned inverted plan view of a part of the transmitter mechanism;

Figs. 5 and 6 are explanatory of the operation of the interrupter cam, Fig. 5 showing the contacts in closed position and Fig. 6 showing the contacts in open position;

Fig. 7 is a diagrammatic view explanatory of the operation of the receiver;

Fig. 8 is a transverse section through the receiver taken in the plane of the line 8—8 of Fig. 11;

Fig. 9 is a transverse section through the receiver taken in the plane of the line 9—9 of Fig. 11;

Fig. 10 is a transverse section of the receiver taken in the plane of the line 10—10 of Fig. 13;

Fig. 11 shows the receiver in side elevation;

Fig. 12 is an end elevation of the same and shows the delay mechanism;

Fig. 13 is a longitudinal section taken in elevation through the receiver;

Fig. 14 is a perspective view explanatory of the cam mechanism for operating the switches;

Fig. 15 shows the reversing switch with the contact springs broken away to expose the slider;

Fig. 16 is a similar view with the contact springs in place and with the slider shifted to opposite position;

Fig. 17 is a side elevation of the switch of Fig. 16 looking from the left;

Fig. 18 is a transverse section through the switch taken in the plane of the line 18—18 of Fig. 15;

Fig. 19 is explanatory of the construction of the contact plates on the slider;

Fig. 20 is a section through the switch taken in the plane of the line 20—20 of Fig. 15;

Fig. 21 is a section through the switch taken in the plane of the line 21—21 in Fig. 16;

Fig. 22 is explanatory of a modification of the contact plates for the Stop and Go switch;

Fig. 23 shows a modified switch for simply opening or closing a circuit, as, for the control of lights, or a bell, or a whistle on the train;

Fig. 24 is a side elevation of the Speed control switch modified to employ three cams in order to shift the slider to any of three positions, so as to obtain three different speeds of operation;

Fig. 25 is a front elevation of the same;

Fig. 26 is a transverse section taken through the slider in the plane of the line 26—26 of Fig. 25, but with the slider shifted to low speed position;

Fig. 27 is a plan view showing the train coupler arranged to be remotely controlled by the receiver;

Fig. 28 is explanatory of the locomotive bell;

Fig. 29 is a schematic wiring diagram explanatory of the invention, with the parts arranged approximately as in the described apparatus; and

Fig. 30 is a similar wiring diagram, but with the parts rearranged to simplify understanding of the receiver circuits.

Referring to the drawings, and more particularly to Fig. 1, the remote control system is shown applied to a toy train, and the complete system comprises a transmitter 12 connected between a suitable source of propulsion current, such as the transformer 14, and the track 16 of the train system. The track carries a locomotive 18, preferably permanently connected to a simulated tender 20 which, in turn, is coupled through a coupling 22 to a train of cars represented in this case by the car 24. The locomotive 18 may be conventional, in comprising a driving motor and a third rail contact shoe or trolley which are not shown on the drawings. It is also provided with a headlight 26, and additionally carries an audible signal, such as a bell, or whistle, or both. The tender 20 is preferably devoted to carrying the receiver of the remote control mechanism. The car 24, and any succeeding cars, may be conventional, and may simulate freight cars or passenger cars, as desired.

The transformer 14 may be conventional and is provided with a plug 28 adapted to be plugged into any convenient wall outlet. The transformer may be of simple character, and only two terminals 30 are needed. A voltage regulating handle is indicated at 32, but this is not essential, for the transformer operates at fixed voltage. The regulating handle is shown, first because these transformers as now made are commonly provided with the same, and second, because it constitutes a convenient way to regulate the output potential so as to feed the desired fixed potential to the track.

The transmitter 12 is of the dial type, it comprising a box or enclosure on the top of which is mounted a rotatable dial 34 having a series of finger-holes 36 therein. Each hole is marked with an appropriate train control function, but these markings have been omitted in Fig. 1 because of the small scale of the drawing. In the specific case here illustrated, there are fourteen holes on the dial, and they are marked to indicate performance of the following operations:

Stop, Go, Bell off, Bell on, Uncouple locomotive, Slow speed, Medium speed, Fast speed, Forward, Backward, Headlight off, Headlight on, Whistle off, Whistle on.

To operate the dial, a finger is inserted in the proper hole and the dial is then turned in clockwise direction until it reaches the stop 38. The dial is then released and moves back to initial position. During its return movement, a series of interruption impulses is sent out to the track corresponding to the number of holes through which the dial has been turned.

Referring now to Figs. 2, 3, and 4 of the drawings, the dial 34 is freely rotatable about the step 40 of screw 42. Screw 42 is received in the upper end of a bushing 44 which is rotatable in a center hole in the cover 46 of the casing 48 of the transmitter. Bushing 44 carries a ratchet wheel 50 at its upper end, and an interrupter cam 52 at its lower end, these being locked in registration by the provision of appropriate flats, one of which is indicated at 54 in Figs. 5 and 6. A similar flat is provided in ratchet wheel 50.

The dial 34 has secured on the bottom face thereof a pair of spring pawls 56, the lower ends of which bear against the top wall of ratchet wheel 50. Wheel 50 is provided with a series of radial holes or slots 58 adapted to receive the ends of pawls 56 when the dial is turning counterclockwise. The pawls slip over the ratchet wheel when the dial is turned clockwise. The clockwise movement of the dial merely winds up a restoring spring 60, and the latter then turns the dial counterclockwise. The restoring spring is a spiral ribbon spring and has its inner end hooked over a lug 62 (Fig. 2) struck upwardly from the top 46. Three similar lugs are provided at 64 to help locate the spring 60 against sideward displacement. The outer end of the spring is bent to form an open hook 66.

The movement of the dial is limited by a dial stop 68 struck upwardly from top wall 46. The dial 34 is provided with a depending finger 70 which is bent downwardly at one end of a strip secured to the dial by the same rivets as are used to hold one of the pawls 56. This finger 70 is disposed between a dial stop 68 and the outer end 66 of spring 60. It will be manifest, from inspection of the drawings, that when the dial is turned clockwise, the finger 70 leaves dial stop 68 and carries the outer end of the spring around with it. The spring is thus wound, and when the dial is released, the spring unwinds and turns the dial back until the finger 70 reaches the dial stop 68.

It will be seen that during restoring movement of the dial, the pawls 56 engage ratchet wheel 50 and rotate the same, and this is accompanied by rotation of bushing 44 and interrupter cam 52.

Referring to Figs. 5 and 6, it may be explained that the interrupter cam 52 is preferably made of insulation and is provided with a series of teeth 74 on the periphery thereof. These teeth bear against contact springs 76 and 78, which are insulatedly secured at their opposite ends to a support plate 80. Springs 76 and 78 are provided with contact points 82, preferably of non-corrosive character. It will be understood, from inspection and comparison of Figs. 5 and 6, that as cam 52 rotates, the contact points 82 are momentarily changed from the closed position shown in Fig. 5, to the open position shown in Fig. 6. When the cam has turned the amount of one tooth, the springs snap back to the closed position of Fig. 5. The contacts are opened once for each tooth. The spacing of the teeth on the cam corresponds to the spacing of the holes on the dial. In the present case, for example, there are sixteen teeth, and the dial holes are spaced at one-sixteenth of the periphery of the dial, although there are only fourteen holes, the space of two holes being left at the bottom to make room for the finger stop 38. It will be seen later, that the receiver is provided with fourteen operating positions, corresponding to the fourteen holes on the dial.

The cam 52 might be used to move a single contact spring, rather than two springs, as here shown, but the use of the two springs is preferable for the following reasons. In the first place, the opening of the contacts is made more abrupt because spring 76 is moved outwardly by the leading tooth at the same time that spring 78 is permitted to spring inwardly by passage of the trailing tooth. In other words, the springs are moved away from each other in opposite directions. Moreover, the spring 76 is elongated and made of such length that the free end thereof bears against the straight wall 84 of one of the teeth when the cam is at rest, and spring 76 thus functions as a holding dog to prevent reverse movement of cam 52. It may be mentioned that Figs. 4, 5, and 6 show the cam looking from the bottom, and that when viewed from the top, the cam is unable to turn clockwise, because of spring 76, and can only turn counterclockwise. Thus, during the dialing operation, the cam is held against movement and the pawls 56 of the dial must ride over the ratchet openings 58. When the dial is released, and is turned counterclockwise by the restoring spring 60, the holes 56 engage the ratchet slots 58 and the ratchet turns the cam, thus moving its teeth past the contact springs 76, 78. It will be understood that there are sixteen ratchet slots 58, corresponding to the teeth of the cam and the holes of the dial.

It is desirable that the transmission of interruption impulses proceed at a uniform rate so that the receiver can be designed to respond to these impulses, and to discriminate between the dialing impulses and some other interruptions which may take place at widely different timing. It is primarily for this reason that the dial functions during the restoring movement so that the speed will not depend upon the whim of the operator using the dial. Moreover, we provide the transmitter with governor mechanism in order to accurately control the rate of transmission of impulses. Specifically, we provide a frame 84, the upwardly bent ends of which are secured to the top wall 46 of the casing by appropriate tongue connections 86. Bushing 44 receives in its lower end a splined shaft 88 which in turn carries a main or first gear 90. As is best shown in Fig. 4, gear 90 meshes with a pinion 92, which carries a gear 94 meshing with a pinion 96, which carries a gear 98 meshing with a pinion 100 acting as a governor shaft. Pinion 100 rotates a weight 102 which is carried on a pin 104 slidable diametrically in the governor shaft and normally urging the weight inwardly toward the governor shaft by reason of a spring 106. Weight 102 revolves within a governor drum 108 which is secured to the top wall 46. During the restoring operation of the dial, the governor weight 102 is revolved at high speed and flies outwardly and bears frictionally against the inside cylindrical wall of drum 108, thus restraining the dial during its restoring movement to the desired speed.

Reverting to Figs. 2 and 3 of the drawings, the top wall 46 of the casing has mounted thereabove a thin cover wall 110 secured by tongue and slot connections 112 at the corners. This cover wall carries the markings for the dial and conceals the various openings and lugs struck upwardly from top wall 46. This concealment is preferably made complete by turning the edge of the large center opening of the cover plate upwardly, as is indicated at 114, thus forming a flange or skirt which extends upwardly toward the bottom of the dial. The box of the transmitter is preferably provided with an overload circuit breaker which may be of the type disclosed in copending application of Willis Rexford, Serial No. 53,701, filed December 10, 1935, now Patent No. 2,144,741, dated January 24, 1939, and in such case, the circuit breaker may be provided with buttons 116 and 118, one of which closes the circuit breaker and the other of which trips the same, thus making it possible to manually deenergize the entire track system at will, and without necessitating any change in the adjustment of the voltage regulating lever 32 of transformer 14.

The receiver, in the present case, is carried within the simulated locomotive tender 20, and the tender is preferably permanently coupled to the locomotive. A flexible cable having a bundle of leads or wires extends between the locomotive and tender and is schematically indicated at 120 in Fig. 1. It will be understood that if the locomotive is large enough in dimension, the receiver may be carried by the locomotive itself. This is particularly true in a simulation of a streamlined train the cars of which may be substantial in length, and, in such case, the motor truck may be disposed near the forward end of the first car and the receiver may be disposed near the rear end of the first car.

The receiver is described in greater detail with reference to Figs. 8 through 26 of the drawings, but it may be helpful to preliminarily explain the ideas underlying the operation of the receiver with reference to the schematic showing in Fig. 7. Referring to that figure, the receiver comprises a toothed drum 122 which is movable both rotatably and axially. It carries at its forward end an operating arm 124. A series of train control elements are disposed radially about the axis of the drum and are adapted to be actuated upon axial movement of the arm 124. In general, the train control elements are switches, and are indicated by the frames 126, 128, etc., with associated operating arms 130, 132, 134, 136, etc. These arms may, for convenience, be called cams, two cams being provided for each switch, one functioning to shift the switch in one direction, and the other to shift it back in the other direction. The cams are disposed in the path of the operating finger 124, and the teeth on drum 122 correspond to the location of the cams, so that the drum and finger 124 may be turned to align the finger 124 with any desired one of the cams.

The drum is rotated by an operating pawl 138, and is held against backward rotation b" a holding detent 140. The operating sequence is a four-step sequence. The first step is the repeated operation of notching pawl 138 until the drum is turned to bring the finger 124 to selected position, as indicated in broken lines at 124'. The cylinder then moves axially through and past the switch cams to the position 122''. During this axial movement, the switch is shifted, or some other train control function accomplished. The operating finger is then at the position 124''. At the end of this axial movement, the toothed drum moves beyond and is disengaged from the notching pawl 138 and the detent 140, and it thereupon turns back to zero position, as is indicated by the broken line position of the finger 124'''. The cylinder then moves axially back to the initial position shown at 122, at which time the notching pawl 138 and detent 140 are again ready to function.

Referring now to Figs. 8, 10, 11, and 13, it will be seen that the toothed cylinder 122 is hollow and slidable on a stationary guide pin 142, one end of which is riveted to frame wall 144. The opposite end of the cylinder is secured to a circular plate having the operating finger 124 projecting integrally therefrom. This, in turn, has riveted thereto one end of a solenoid core 146 which cooperates with an operating solenoid 148. The solenoid is secured to end wall 150 of the frame and has a bearing hole through which passes a center guide spindle 152 the inner end of which is screwed into solenoid core 146 at 154 and the outer end of which has connected thereto one end of a thin helical spring wire 156. The opposite end of the spring wire is fixedly secured on wall 150 by means of a lug 158 (Fig. 11). The spring 156 acts in tension to move the cylinder axially to the starting position, that is, to the solid line position of Fig. 13, and it acts in torsion to turn the cylinder back toward zero position, that is, the solid line position shown in Fig. 10. This zero position is determined by a stop arm 160, best shown in Figs. 7 and 9. The end of said stop arm is dimensioned to be received in an extra large notch 162 formed by omitting two teeth on the drum, so that the drum has fourteen teeth though at a spacing equivalent to the use of sixteenth teeth. It may be mentioned, in connection with Fig. 7, that stop arm 160 remains in engagement with the toothed cylinder 122 even after the cylinder has moved axially forward to the position 122''. Hence, the cylinder is properly stopped at zero after it has moved forward out of engagement with the notching pawl 138 and detent 140.

The notching pawl 138 is best shown in Figs. 8 and 11, and it consists of a tooth formed on a relatively large member the lower end 164 of which is slidable in a mating slot cut through the base 166 of the frame, while the upper end 168 is slidable through a slot cut through the top wall 170 of the frame. The upward projection 168 is tapered, as shown in Fig. 8, thus permitting the pawl to tilt inwardly toward the drum while notching a tooth of the drum upwardly. The tooth is disengaged at the end of the upward stroke and during the downward stroke. The pawl is normally urged downwardly and inwardly by a tension spring 172, clearly shown in Fig. 8. The notching pawl is slotted at 174 to receive the forward end 176 of an armature 178 made of magnetic material, and the other end of which has sidewardly projecting ears 180 received in slots 182 cut through the side walls 184 of the frame. It may be mentioned that the frame comprises a piece of sheet metal bent to inverted U-shape and forming the vertical walls 150 and 144 connected by the top wall 170, and another piece of sheet metal bent to inverted U-shape and forming the side walls 184 connected by a top wall 186 which is in substantial alignment with the top wall 170. These two frame members are connected to one another and to the bottom plate 166 (which is also the chassis of the tender) by appropriate tongue and slot connections. The frame is completed by a partition wall 188 secured between top wall 170 and bottom wall 166.

Armature 178 is made of iron and is adapted to be drawn upwardly by a notching magnet 190, the fixed core of which is indicated at 192. The notching pawl 138 is shown in elevated position in Fig. 8, and this is its normal position, for the notching magnet is energized at all times and is permanently connected across the trolley to ground. When current supply to the track is interrupted, the notching magnet is deenergized, the armature 178 and pawl 138 drop, and when the track is again energized, the armature and pawl are elevated, thus notching the drum around in a clockwise direction, as viewed in Fig. 8.

The drum is held in notched position by detent 140, best shown in Fig. 8. This detent is pivoted at 194 to partition wall 188. Its opposite end may be bent sidewardly and received in an arcuate slot 196, thereby guiding the detent and limiting its movement. The detent is preferably provided with two relatively widely spaced teeth 198, as is clearly shown in Figs. 7 and 8, the object of this construction being to successfully hold the drum as it is moved tooth by tooth, and despite the extra large notch 162, the detent teeth 198 being spaced far enough apart to straddle or overcome the effect of the large or zero notch 162.

The stop arm 160 has already been referred to, but it may next be explained that this stop arm functions additionally to control a switch in series with the operating solenoid 148. For convenience, we shall refer to this switch as a zero switch. Referring to Figs. 9 and 10, the switch comprises a stationary contact 200 mounted on an insulation support 202 extending between frame walls 150 and 188 (Fig. 11). This cooperates with the movable contact 204 carried on leaf spring 206 the stationary end of which is riveted to insulation support 202 at 208. The zero arm 160 is pivotally mounted on wall 188 by means of pivot 210. The lower arm 212 (Fig. 9) of the lever is disposed outside the movable end of the spring strip 206. It will be evident, from consideration of Fig. 9, that with the drum in zero position, and arm 160 in the solid line position, the contacts 200 and 204 are open, whereas when drum 122 is moved away from zero position, the arm 160 is moved to the broken line position, thereby closing the contacts. By connecting the zero switch in series with the operating solenoid 148, the latter is normally deenergized. It is energized only during a dialing operation. The operating solenoid is made too sluggish in response (either inherently or by using a delay solenoid later described) to respond to the short impulses of current during the dialing operation, but at the end of the dialing operation, after the cylinder has been notched to proper position, the operating solenoid pulls the cylinder 122 and operating finger 124 forwardly, as was explained in connection with Fig. 7. At the end of the forward movement, and after the selected switch has been shifted, the toothed cylinder 122 is disengaged from detent 140 but is still held forward by the energization of the operating solenoid 148. The cylinder turns counterclockwise to zero position under the influence of spring 156. At the zero position, the zero arm 160 moves inwardly from the broken to the solid line position of Fig. 9, thus opening the zero switch contacts 200, 204, and thereby de-energizing the operating solenoid 148. The cylinder thereupon moves rearwardly to initial position under the influence of spring 156.

To prevent premature operation of the operating solenoid 148, we provide a special delay solenoid 214. This is preferably arranged with its axis vertical and is provided with a plunger 216 (Fig. 13) which is normally disposed well below solenoid 214. The starting position may be adjusted by an adjusting screw 218 threadedly received in the bottom 166 of the frame. The ferrous core 216 is guided in a brass or other non-magnetic tube 220, and said tube is preferably slit at 222 to receive a pin 224 projecting sidewardly from the core. Pin 224 is designed to close a normally open delay switch comprising a stationary contact 226 (Fig 12) and a movable contact 228 carried on an insulation plate 230, one end of which is provided with outwardly projecting ears 232 received in slots 234. It will be evident, from inspection of the drawings, particularly Fig. 12, that if plunger 216 is fully elevated, it closes the contacts 226, 228. The response of plunger 216 is, however, slow because of the very small starting attraction due to its low position. During the dialing operation, the plunger 216 vibrates up and down a small amount, but is unable to reach maximum elevation. At the end of the dialing operation, however, it is drawn fully into solenoid 214, thereby closing the contacts of the delay switch, and these are connected in the circuit leading to the operating solenoid 148. In this way, the operating solenoid is energized only at the end of the dialing operation. The delay solenoid 214 is preferably so wired that its circuit is opened when the zero switch 200, 204, previously referred to, is opened. Hence, the delay solenoid is normally deenergized and consumes no current except during the dial operation.

The construction of the various switches disposed radially about the drum will next be described, but reference is preliminarily made to Figs. 29 and 30 of the drawings, in order to explain the functional requirements of the switches. Fig. 29 is a wiring diagram which shows the parts somewhat as actually located in the apparatus (though no attempt has been made to properly locate the switches about the circle, they being merely disposed around a circle to schematically represent the radially disposed switches). The parts carried by the locomotive are shown at the left of Fig. 29 and include the headlight 26, a bell assembly 240, a driving motor the armature of which is indicated at 242 and the field of which is indicated at 244, and a third rail contact shoe or trolley 246. The cable extending from the locomotive to the tender includes the bundle of conductors indicated at 120. The receiver in the tender includes the horizontal operating solenoid 148, the notching magnet 190, and the delay solenoid 214, which controls the operation of delay switch contacts 226, 228. The zero switch is shown at 200, 204, it being controlled by the zero arm 160. The tender also carries the radially disposed train control switches, and a speed regulating resistor 250. The train is also provided with a whistle, this being of a type in which a motor indicated at 252 drives a fan or impeller indicated at 254 in order to blow air through appropriate whistle pipes 256, and, in the present case, the whistle mechanism is indicated as mounted in the tender, but it will be understood that this mechanism may be mounted in either the locomotive or tender.

The wiring diagram of Fig. 29 has been rearranged in Fig. 30 in order to show the electrical connections in simpler form. Conductor 260 is connected to the trolley while conductor 262 represents ground. The notching magnet 190 is connected at all times across the supply circuit, and is normally energized. Interruption impulses caused by the dial transmitter cause the notching pawl to function. As the toothed cylinder is turned away from zero, the zero switch 200, 204 is closed, thereby energizing the delay magnet 214. At the end of the dialing operation, the delay magnet succeeds in closing the delay contacts 226, 228, thereupon energizing the operating solenoid 148. This shifts the appropriate switch.

We shall first describe the direction reversing switch 264. As will be seen in Fig. 30, there are four contacts, and when these are joined in a vertical direction, as shown at 264, the locomotive will run in one direction, say, forward. If, however, the contacts are joined in a horizontal direction, as is shown at 264', the locomotive will run backward, for the direction of current flow through the field is reversed.

The manner in which this change of connection is obtained is next described with reference to Figs. 15 through 21 of the drawings, which show the reversing switch. The switch comprises a strip of insulation 266 the ends of which are reduced and shouldered at 268 to form tenons which are received in mating slots in frame walls 150 and 188. Insulation strip 266 is cut away at the middle to form a slot or frame in which a slider 270 is slidable. This slider is preferably a strip of insulation of the same thickness as frame 236. It is provided on its opposite sides with contact plates having outwardly projecting guides 272. These guides hold the slider in the frame and guide it during its movement longitudinally of the frame. The slider is shifted by operating arms or cams 274 and 276. These are freely pivotally mounted on opposite sides of frame 266 by means of a pin 278. A link 280 made of a thin piece of sheet metal connects slider 270 and the cams 274, 276. One end of link 280 is provided with a tongue 282 (Fig. 17) which is received in a slot in the slider. The opposite end of link 280 underlies cam 274 and is slotted at 284 (Fig. 15) to straddle the pin 278. Link 280 is provided with a lug 286 bent toward one side to engage the cam 274, and another lug 288 bent toward the opposite side to engage the cam 276 (Fig. 18). It will be observed that the lugs 286 and 288 are disposed on opposite sides of pin 278. Hence, they are moved in opposite directions by the cams. Specifically, in Fig. 15, the slider is nearest the cams, it having been moved there by a push in the opposite direction on cam 274. This operating movement of cam 274 was transmitted through lug 286 and was accompanied by an opposite or restoring movement of cam 276 caused by lug 288.

This movement may be clarified by reference to Fig. 14, in which it will be seen that link 290 is provided with oppositely bent lugs 292 and 294, these being disposed on opposite sides of the axis 296 of the cams 298 and 300. The parts are in position for operation on cam 300, and when cam 300 is pushed away by the operating finger, it produces a forward movement of link 290 and that forward movement causes a forward or restoring movement of cam 298 by reason of the lug 294. Thus, the rearward movement of cam 300 is accompanied by a forward movement of cam 298, and cam 298 is restored to initial position ready to be operated upon. When it is operated on and pushed rearwardly, the parts assume the position shown in Fig. 14, and, at this time, the cam 300 is again brought forward ready to be operated upon.

Reverting now to Figs. 16 and 17, the frame 266 carries four contact springs 302, the movable ends of which bear against the slider 270, and the stationary ends of which are insulatedly secured to the switch frame 266 by blocks of insulation 304. These four contact springs correspond to the four circular contacts indicated at 264 in Fig. 30.

The slider 270 carries metallic contact plates. In Fig. 15, the contact springs 302 have been cut away, and the shape of the nearer contact plate is clearly shown. It may be explained, however, that sidewardly projecting extensions of the contact plate are bent around the edge of the slider onto the opposite face, as is indicated at 306 and 308. The contact plate on the opposite side is similar, but reversed in position, and its reversely bent lugs are indicated at 310 and 312. The construction may be clarified by reference to Fig. 19, in which the two contact plates are shown with the insulation slider removed from between the same. The upwardly and inwardly bent parts 310 and 312 are formed integrally with the bottom or remote contact plate 314. The parts 306 and 308 are bent downwardly and inwardly from the upper contact plate 316.

In Fig. 15, the slider is shown moved toward the cams, and in this position, the contact springs bear against the cross-bars of the contact plates, that is, the parts extending between the guides 272. The situation is then as shown in Fig. 20, in which it will be seen that the upper contact springs are directly connected by the top contact plate 316, while the bottom contact springs are connected by the bottom contact plate 314. This corresponds to the forward position shown at 264 in Fig. 30. In Figs. 16 and 17, the slider has been moved remote from the cams, and the contact springs now bear against the reversely bent parts of the contact plates. The situation is as indicated in Fig. 21, in which it will be seen that the top and bottom contacts at one side are connected together by the reversely bent parts of one of the contact plates, while the top and bottom contacts on the other side are connected together by the reversely bent parts of the other contact plates. This corresponds to the switch position shown at 264' in Fig. 30, and results in reversing the motor, and, consequently, the locomotive.

In Figs. 29 and 30, it will be seen that a number of switches may be of the simple on-and-off type. This applies to the switch 320 for the headlight, the switch 322 for the bell, and the switch 324 for the whistle (shown in Fig. 29, but omitted in Fig. 30. The diagrams are otherwise alike.) A switch for this purpose is shown in Fig. 23, and the principal change is the omission of two of the spring contacts 302. Figs. 15 and 16 may be considered front elevations of the switch shown in Fig. 23, and it will be understood that when the slider is shifted to a position near the cams, the two spring contacts are joined by the cross-bar of the upper contact plate 316, while when the slider is shifted to a position remote from the cams, the contacts are disconnected from one another, as is shown in Fig. 16. From an electrical viewpoint, the rear contact plate 314 may be omitted, but it is retained for structural reasons, in order to provide the four outwardly projecting guides 272 which retain and guide the slider 270 in the switch frame.

The stop and go switch for the locomotive could be a simple on-and-off switch, such as has last been described. However, we find that it is desirable to use a compensating resistor in association with the delay solenoid. This resistor is shown at 326 in Figs. 29 and 30. It is connected in series with delay solenoid 214 when the locomotive is not running, thereby reducing the potential applied to the delay solenoid. When the locomotive is running, the driving motor draws a relatively heavy current and reduces the effective potential applied to the delay solenoid. By cutting out the compensating resistor 326, this loss of potential is compensated for and the time delay introduced by the delay solenoid is maintained substantially constant. The switch problem, then, is to cut out the compensating resistor 326 whenever the locomotive is running.

For this purpose, the Stop and Go switch is provided with four contact springs instead of two. It is shown at 328 in Fig. 30, and it will be seen that in the stop position the contacts are open, and in the go position 328' the right-hand contacts are connected to energize the motor while the left-hand contacts are connected to short-circuit the compensating resistor 326. It will also be observed, in Fig. 30, that no harm results if the top contacts are connected for the stop position, for both of these contacts are connected to the trolley.

Reverting now to the switch drawings, the Stop and Go switch is constructed substantially as was described in connection with the reversing switch of Figs. 15, 16, and 17, but one of the reversely bent parts of a contact plate, for example, the part 310 in Fig. 19, is omitted, the construction then being as shown in Fig. 22. On reflection, it will be seen that when the slider is shifted to a position near the cams, the pair of contacts on each side of the switch are directly connected by the cross-bars of the contact plates, and this corresponds to the go position shown at 328' in Fig. 30. When the slider is shifted to a position remote from the cams, the situation is as indicated at 328 in Fig. 30, due to the removal of reversely bent part 310. The reversely bent part 306 may also be removed, but this is not necessary if the contact springs on that side of the switch are the ones connected to the trolley.

The Speed control switch is more complex than the Reversing switch, in being a three-position switch, that is, the slider may be stopped at an intermediate position half-way between the end positions heretofore referred to. This intermediate position is indicated by the section line 26—26 in Fig. 25, and referring to Fig. 26, it will be seen that all of the spring contacts are open-circuited.

Referring to Fig. 30, the Speed control switch is indicated at 330. The four contact springs are so connected that with the switch contacts opened, as shown at 330, most of the speed control resistor 250 is connected in series with the motor. If the contacts are connected in a vertical direction, as is indicated at 330', one section of resistor 250 is cut out, this increasing the speed from slow to medium. If the contacts are connected in a horizontal direction, as is indicated at 330'', two sections of the resistor are cut out and the locomotive will operate at Fast speed. The connections to the resistor may be made adjustable as shown, but this adjustment is left fixed when once placed at the desired value. In the fast position, all of the resistor may be cut out, if desired.

Reverting now to Figs. 24 and 25, the mid-position of the slider, corresponding to Slow speed, is obtained by the addition of a third cam 332. This is provided at its rear or outer end with a transversely bent centering arm 334 adapted to bear against the rearwardly projecting arms 336 of the two regular cams 338 and 340. Arm 334 is disposed at a radial distance from pivot 278 great enough to act in one direction only on the cams (in contrast with the lugs bent oppositely from the slider link which cooperate with the cams for movement in either direction). Referring to Figs. 7 and 10, it will be seen that the third or extra cam 332 is so spaced relative to the other cams as to constitute one of the cams distributed uniformly about the axis of the operating finger 124, and the Speed control unit is preferably disposed adjacent the train coupling unit which has only a single cam or arm 342.

Referring now to Figs. 20, 21, 25, and 26, it will be understood that upon operation of cam 340, as shown in Fig. 25, the slider is moved away from the cams to a position corresponding to Fig. 21. This is the high speed position shown at 330'' in Fig. 30. It will be observed that cam 332 is so shaped that it is not moved all the way forward, the same as cam 338, but is moved only half-way forward. Upon operation of cam 332, the cross-arm or centering arm 334 moves cam 338 rearwardly to intermediate position, and this moves the slider to intermediate position, which, at the same time, moves the cam 340 forwardly to intermediate position. This corresponds to Fig. 26 and to the open circuit or slow speed position shown at 330 in Fig. 30. Upon operation of cam 338, the slider is moved to a position corresponding to Fig. 20, and this corresponds to the medium speed position shown at 330' in Fig. 30.

The uncoupling system may be described with reference first to Fig. 27. The tender is provided with a coupler having a stationary jaw 344 and a movable jaw 346 pivoted at 348. Jaw 346 is normally urged to open position by a pull spring 350, but may be held in locked position by a latch 352 pivoted at 354, and normally urged into latching position by the same spring 350. The car being pulled has a coupler 356 provided with an approximately cylindrical upstanding element 358, said element being larger than the space between the jaws when the jaws are closed. The movable jaw 346 is provided with an arm 360 which extends transversely across the jaws when the jaws are open. Thus, if the couplers are moved together, the male element 356 passes between the open jaws and bears against the arm 360, thus closing and latching the jaws, as shown in Fig. 27. The coupling is then in position to pull the train of cars and remains so until the latch 352 is tripped.

This arrangement probably requires no greater detailed description, and is completely described in the copending application of Willis E. Rexford, Serial No. 81,834, filed May 26, 1936, now Patent No. 2,157,187, dated May 9, 1939. The present invention deals primarily with the method of tripping the latch 352, and in Fig. 27, it will be seen that a cord 362 extends from latch 352, and if pulled, will release the latch. Referring now to Figs. 10, 11, and 13, it will be seen that the opposite end of the cord 362 is connected to the upper end of a lever 342 pivoted at 364 on a support strip 366 which is secured between frame plates 150 and 188 by tenon and slot connections, just as was described in connection with the switches. The upper end of lever 342 projects through a slot 368 in the top wall 170 of the frame. Cord 362 may be guided downwardly around the frame by a suitable friction-reducing guide eyelet 370, as is shown in Fig. 11. If the receiver is so arranged in the tender that this eyelet is towards the front of the tender, then the cord is trained rearwardly beneath the chassis of the tender to the coupler, as is indicated by the cord 362 leading to coupler 22 in Fig. 1. It will be manifest, from inspection of Fig. 13, that when the operating finger 124 is aligned with the cam 342 and is then pulled forwardly by the operating solenoid 148, the arm is shifted from the solid line position to the broken line position, thus pulling the cord 362 and thereby releasing the coupling.

The locomotive bell may be described with reference to Figs. 28, 29, and 30, and comprises a cup-shaped bell member 372, a solenoid 374, and a bell striker 376. This is urged by a spring 378 to strike the bell. When the solenoid is energized, the bell striker is drawn into the solenoid, and if the solenoid is then released, the bell striker hits the bell. For realism, it is important that the successive strokes of the bell take place at widely spaced intervals of time. If this is done by gear reduction, a very large reduction ratio is needed and the speed of operation of the bell varies with variations in speed of the locomotive. Moreover, the bell is frequently rung when the locomotive is stationary, and that would not be possible with a geared arrangement. We have found that the desired result may be obtained through the use of a thermostatic switch, schematically designated in Fig. 28 by the rectangle 380, but shown in greater detail in Figs. 29 and 30, in which it will be seen that a thermostat switch bar 382 (a bimetallic strip) is arranged near a heating resistance 384 connected in shunt with the bell solenoid 374. The result is a spaced periodic opening and closing of switch contacts 386, with consequent spaced intermittent ringing of the bell. If a whistle is used instead of or in addition to the bell, it may be of the character already known and heretofore described in connection with Fig. 29. Inasmuch as this type of whistle is driven by an electric motor, it is merely necessary to switch the motor on or off under remote control, just as is done with the headlight or the bell.

It is believed that the operation of our improved remote control train system will be apparent from the foregoing detailed description thereof. Any desired command is transmitted from a remote control point by simply dialing that command on the transmitter. This sends out a series of interruption impulses which correspond to the command. The notching magnet responds to these impulses and causes the notching pawl to rotate the toothed drum until the operating finger is aligned with the proper switch or control element. Upon rotation of the drum away from the zero position, the zero switch is closed, thus energizing the delay solenoid, but this is unable to respond during the dialing operation. At the end of the dialing operation, when a steady current is again applied, the delay solenoid functions and closes a delay switch, thereby energizing the operating solenoid which pulls the drum and operating finger past the radially disposed switches. This operates one or another of the switches, or mechanically operates a responsive element, such as the coupler, to produce the desired train function. When the operating finger has been pulled past the switch, the drum has moved beyond the notching pawl and holding detent, and is free to turn back to zero position. At this time, the zero switch is again opened, thus deenergizing the delay solenoid and the operating solenoid, and the drum slides back to initial position. The receiver is then ready to receive another command.

The advantages of our improved remote control system will be apparent without further comment, for it makes possible independent control of any and all of a large number of train control functions while using only the regular propulsion current for signalling purposes. No special wires, rails, or kinds of current are needed. In fact, the power applied to the track is preferably applied at constant potential, and this constitutes another advantage of the system in that the various train and trackside signalling accessories may all be energized directly from the track system at constant potential.

It will be understood that if the train simulates a passenger train rather than a freight train, the cars may be lighted by lamps connected in a circuit leading up to the receiver or tender, so that all of the lights may be switched on or off with the headlight, or independently of the headlight if an additional switch is provided.

It will also be understood that the switches may be rearranged to permit them to function with fewer holes on the dial. Specifically, a third cam, like the slow speed cam on the Speed control switch, may be added to the Reversing switch, and the midposition will then function to stop the locomotive. In this way, Forward, Stop, or Backward may be dialled directly instead of first dialing the direction and thereafter dialing Go. Moreover, for the simple on-and-off switches, the switch may be designed with a single cam or lever, this being such that when moved once, it turns the switch on, and when moved again it turns the switch off, and so on. This may be applied to the headlight, bell, and whistle switches. In this way, four positions are eliminated and ten holes are used on the dial instead of fourteen. The spacing of the holes and interrupter cam teeth and drum teeth may be adjusted for twelve teeth, thus providing a space of two teeth for the finger stop on the dial and for the zero notch on the drum. Of course, the same number of holes and teeth may be used as at present, in which case a number of additional train control functions may be provided for.

It will be understood that while we have illustrated the invention as applied to a train running on rails, it may also be applied to a vehicle simulating an automobile, for example, running on a simulated speedway.

It will, therefore, be apparent that, while we have shown and described our invention in a preferred form, many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention defined in the following claims.

We claim:

1. A remote control system for toy trains normally supplied with power through a power rail, said system including a train-carried toothed movable control member, a notching magnet, a notching pawl operated by said magnet for moving said control member tooth by tooth to a selected control position depending upon the number of short impulses of power applied to the notching magnet through said power rail, operating means responsive to continuous power for causing said control member to function in order to effect a control operation dependent upon the selected position of the control member, and delay means to prevent functioning of the operating means during the transmission of notching impulses.

2. A remote control system for toys, comprising a rotatable and axially movable toothed drum carrying an operating finger, resilient means normally restoring said drum to zero position, a notching magnet, a notching pawl operated by said magnet for rotating said drum tooth by tooth to bring the operating finger to a selected position, a holding pawl, an operating solenoid arranged to function after functioning of said notching magnet, said solenoid moving said drum and operating finger axially past a series of control devices disposed radially about the drum in order to operate a selected one of said devices, said axial movement being large enough to move said drum past said notching and holding pawls, whereupon said resilient means restores said drum to zero position.

3. A remote control system for toy trains, comprising a rotatable and axially movable toothed drum carrying an operating finger, resilient means normally restoring said drum to zero position, a notching magnet, a notching pawl operated by said magnet for rotating said drum tooth by tooth to bring the operating finger to a selected position, a holding pawl, an operating solenoid for moving said drum and operating finger axially past a series of train control devices disposed radially about the drum in order to operate one of said devices, said axial movement being large enough to move said drum past said notching and holding pawls, whereupon said resilient means restores said drum to zero position, and delay means for preventing operation of said operating solenoid during the notching of the drum to selected position.

4. In a remote control system for toy trains, a circuit including a source of current, a track, a stationary trackside dial transmitter and a train carried receiver and a train carried motor both responsive to current sent through said dial transmitter, said transmitter including a rotatable dial provided with finger holes, a spring for restoring said dial to zero position, a dog on said dial, a ratchet wheel driven by said dog during restoring movement of the dial, a cam turned by said ratchet wheel, and contacts moved by the teeth of said cam, said train-carried receiver including a movable toothed member, a notching magnet responsive to the short rapid impulses transmitted by the dial, a pawl moved by said magnet for moving said member tooth by tooth to a selected position determined by the number of impulses transmitted from the dial transmitter, and means responsive to a longer maintained current but not responsive to said rapid impulses to produce a control response dependent on the position of the member.

5. In a remote control system for toy trains,

a circuit including a source of train propulsion current, a track, a stationary trackside dial transmitter, and a train carried receiver and a train carried motor both responsive to current sent through said dial transmitter, said transmitter including a rotatable dial provided with finger holes, a spring for restoring said dial to zero position, a dog on said dial, a ratchet wheel driven by said dog during restoring movement of the dial, an interrupter cam turned by said ratchet wheel, normally closed contacts momentarily opened by the teeth of said interrupter cam, said contacts being connected in series with said current source and the track, and a governor connected to said interrupter cam by a train of step-up gearing for regulating the speed of impulse transmission, and said train-carried receiver including a movable toothed member, a notching magnet responsive to the short rapid impulses transmitted by the dial, a pawl moved by said magnet for moving said member tooth by tooth to a selected position determined by the number of impulses transmitted from the dial transmitter, and means responsive to a longer maintained current but not responsive to said rapid impulses to produce a control response dependent on the position of the member.

6. In a remote control system for toys, a circuit including a dial transmitter and a remote receiver and a train carried motor both responsive to current sent through said dial transmitter, said transmitter including a rotatable dial provided with finger holes, a spring for restoring said dial to zero position, a dog on said dial, a ratchet wheel driven by said dog during restoring movement of the dial, a cam turned by said ratchet wheel, and contacts moved by the teeth of said cam, and said receiver including a movable toothed control member, a notching magnet responsive to the short rapid impulses transmitted by the dial, a notching pawl operated by said magnet for moving said control member tooth by tooth to a selected position, and operating means causing said control member to function only after functioning of the notching magnet in order to effect a control operation dependent upon the selected position of the control member, said operating means being responsive to a longer maintained current but not responsive to said rapid impulses.

7. In a remote control system for toy trains, a circuit including a stationary trackside dial transmitter and a train carried receiver and a train carried motor both responsive to current sent through said dial transmitter, said transmitter including a rotatable dial provided with finger holes, a spring for restoring said dial to zero position, a dog on said dial, a ratchet wheel driven by said dog during restoring movement of the dial, a cam turned by said ratchet wheel, and contacts moved by the teeth of said cam, and said train-carried receiver including a toothed movable control member, a notching magnet responsive to the short rapid impulses transmitted by the dial, a notching pawl operated by said magnet for moving said control member tooth by tooth to a selected position, operating means causing said control member to function in order to effect a control operation dependent upon the selected position of the control member, and delay means to prevent functioning of the operating means during transmission of notching impulses, whereby said operating means is responsive to a longer maintained current but not responsive to said rapid impulses.

8. In a remote control system for toys, a circuit including a dial transmitter and a remote receiver responsive to current sent through said dial transmitter, said transmitter including a rotatable dial provided with finger holes, a spring for restoring said dial to zero position, a dog on said dial, a ratchet wheel driven by said dog during restoring movement of the dial, a cam turned by said ratchet wheel, and contacts moved by the teeth of said cam, and said receiver including a rotatable and axially movable toothed drum carrying an operating finger, a notching magnet responsive to the short rapid impulses transmitted by the dial, a notching pawl operated by said magnet for rotating said drum tooth by tooth to bring the operating finger to a selected position, and an operating solenoid arranged to function after functioning of said notching magnet, said solenoid moving said drum and operating finger axially past a series of toy control devices disposed radially about the drum in order to operate one of said devices, said solenoid being responsive to a longer maintained current but not responsive to said rapid impulses.

9. In a remote control system for toy trains, a source of train propulsion current, a track, a stationary trackside dial transmitter and a train carried receiver responsive to current sent through said dial transmitter, said transmitter including a rotatable dial provided with finger holes, a spring for restoring said dial to zero position, a dog on said dial, a ratchet wheel driven by said dog during restoring movement of the dial, an interrupter cam turned by said ratchet wheel, normally closed contacts momentarily opened by the teeth of said interrupter cam, said contacts being connected between said source and track, and a governor connected to said interrupter cam by a train of step-up gearing for regulating the speed of impulse transmission, and said train-carried receiver including a rotatable and axially movable toothed drum carrying an operating finger, a notching magnet responsive to the short rapid impulses transmitted by the dial, a notching pawl operated by said magnet for rotating said drum tooth by tooth to bring the operating finger to a selected position, an operating solenoid for moving said drum and operating finger axially past a series of train control devices disposed radially about the drum in order to operate one of said devices, and delay means for preventing operation of said operating solenoid during the notching of the drum to selected position, whereby said solenoid is responsive to a longer maintained current but not responsive to said rapid impulses.

10. A remotely controlled train-carried speed control system for toy trains, said system comprising a driving motor, a train-carried speed regulating resistor, a train-carried speed control switch for cutting in or out a desired amount of said resistor, and a manually operable stationary track-side transmitter for moving said speed control switch to desired position at the will of the operator.

11. A remotely controlled train-carried speed control system for toy trains, said system comprising a driving motor, a train-carried speed regulating resistor, a train-carried speed control switch having low, medium and high speed positions for cutting in or out a desired amount of said resistor, train-carried remotely controllable means for operating said switch, and a manually operable stationary trackside transmitter for transmitting control impulses to said remotely

controlled means for moving said speed control switch to the desired position at the will of the operator.

12. A receiver for a remote control system for toys, said receiver comprising a rotatable and axially movable toothed drum, a solenoid plunger connected to one end of said drum, an operating solenoid for attracting said plunger and thereby axially moving the drum, means for normally moving the drum rotatively to zero position and axially to retracted position, a plurality of switches disposed radially about the drum, cams associated with each of said switches for shifting the switches, an operating finger carried by said drum and movable therewith, rotative movement bringing said finger in alignment with a selected one of the cams, and axial movement causing movement of the cam and consequent shifting of the associated switch, a notching magnet, and a notching pawl moved by said magnet for rotating said drum.

13. A receiver for a remote control system for toys, said receiver comprising a rotatable and axially movable toothed drum, a solenoid plunger connected to one end of said drum, an operating solenoid for attracting said plunger and thereby axially moving the drum, means for normally moving the drum rotatively to zero position and axially to retracted position, a plurality of switches disposed radially about the drum, an operating finger carried by said drum and movable with said drum, rotative movement bringing said finger into alignment with a selected one of the switches and axial movement causing shifting of the switch, a notching magnet, a notching pawl moved by said magnet for rotating said drum, a holding detent for said drum, the axial movement of the drum being far enough to disengage the drum from the notching pawl and holding detent, thereby permitting restoration of the drum to zero position after said axial movement.

14. A receiver for a remote control system for toys, said receiver comprising a rotatable and axially movable toothed drum mounted with its axis horizontal, a solenoid plunger connected to one end of said drum, an operating solenoid for attracting said plunger and thereby axially moving the drum, a spring for normally moving the drum rotatively to zero position and axially to retracted position, a plurality of switches disposed radially about the operating solenoid, an operating finger carried by said drum and movable with said drum, rotative movement bringing said finger into alignment with a selected one of the switches and axial movement causing shifting of the switch, a notching magnet, a notching pawl moved by said magnet for rotating said drum, a normally open zero switch causing opening of the circuit to the operating solenoid, said switch being closed upon notching of the drum.

15. A receiver for a remote control system for toys. said receiver comprising a rotatable and axially movable toothed drum mounted with its axis horizontal, a solenoid plunger connected to one end of said drum, an operating solenoid for attracting said plunger and thereby axially moving the drum, a spring for normally moving the drum rotatively to zero position and axially to retracted position, a plurality of switches disposed radially about the operating solenoid, an operating finger carried by said drum and movable with said drum, rotative movement bringing said finger into alignment with a selected one of the switches and axial movement causing shifting of the switch, a notching magnet, a notching pawl moved by said magnet for rotating said drum, a delay solenoid disposed with its axis vertical and having its plunger below said solenoid so far as to slow the plunger response, contacts closed by said plunger when said plunger is elevated, said contacts functioning to close the circuit to the operating solenoid.

16. A receiver for a remote control system for toys, said receiver comprising a rotatable and axially movable toothed drum mounted with its axis horizontal, a solenoid plunger connected to one end of said drum, an operating solenoid for attracting said plunger and thereby axially moving the drum, a spring for normally moving the drum rotatively to zero position and axially to retracted position, a plurality of switches disposed radially about the operating solenoid, an operating finger carried by said drum and movable with said drum, rotative movement bringing said finger into alignment with a selected one of the switches and axial movement causing shifting of the switch, a notching magnet, a notching pawl moved by said magnet for rotating said drum, a holding detent for said drum, and a normally open zero switch causing opening of the circuit to the operating solenoid, said switch being closed by a switch arm bearing against the drum during notching of the drum, the axial movement of the drum being far enough to disengage the drum from the notching pawl and holding detent, but not from the zero switch arm, said drum having an extra deep notch receiving said zero switch to open said zero switch when the drum is restored to zero.

17. A receiver for a remote control system for toys, said receiver comprising a rotatable and axially movable toothed drum mounted with its axis horizontal, a solenoid plunger connected to one end of said drum, an operating solenoid for attracting said plunger and thereby axially moving the drum, a spring normally moving the drum rotatively to zero position and axially to retracted position, a plurality of switches disposed radially about the operating solenoid, an operating finger carried by said drum and movable with said drum, rotative movement bringing said finger into alignment with a selected one of the switches and axial movement causing shifting of the switch, a notching magnet, a notching pawl moved by said magnet for rotating said drum, a holding detent for said drum, a delay solenoid disposed with its axis vertical and having its plunger below said solenoid so far as to slow the plunger response, contacts closed by said plunger when said plunger is elevated, said contacts functioning to close the circuit to the operating solenoid, a normally open zero switch in series with said delay magnet, said switch being closed by a switch arm bearing against the drum during notching of the drum, the axial movement of the drum being far enough to disengage the drum from the notching pawl and holding detent, but not from the zero switch arm, said drum having an extra deep notch receiving said zero switch arm to open said zero switch when the drum is restored to zero.

18. A remote control system for toy trains, comprising a rotatable and axially movable toothed drum carrying an operating finger, a notching magnet, a notching pawl operated by said magnet for rotating said drum tooth by tooth to bring the operating finger to a selected position, an operating solenoid arranged to function after said notching magnet for moving said

drum and operating finger axially past a series of train control switch operating cams disposed radially about the drum in order to operate one of said switches, each of said switches comprising a frame, a slider slidable on said frame, spring contacts secured to said frame and bearing against said slider, a pair of oscillatable cams secured on opposite sides of the frame at the other end thereof, means connected to said slider and having a lug on one side for cooperation with one cam and a lug on the other side for cooperation with the other cam, said lugs being on opposite sides of the axis of the cams.

19. A remote control system for toy trains, comprising a rotatable and axially movable toothed drum carrying an operating finger, resilient means normally restoring said drum to zero position, a zero switch which is normally open but closed when the drum is turned from zero position, a notching magnet, a notching pawl operated by said magnet for rotating said drum tooth by tooth to bring the operating finger to a selected position, a holding pawl, an operating solenoid energized when said zero switch is closed for moving said drum and operating finger axially past a series of train control devices disposed radially about the drum in order to operate a selected one of said devices, means associated with said zero switch and solenoid and operable only when energized for an appreciable length of time greater than the notching impulses required for the notching mechanism, the axial movement of the drum being large enough to move said drum past said notching and holding pawls, whereupon said resilient means restores said drum rotatively to zero position, following which the opening of said zero switch deenergizes the operating solenoid so that said resilient means restores said drum axially to initial position.

20. A remote control system for toy trains, comprising a rotatable and axially movable toothed drum carrying an operating finger, resilient means normally restoring said drum to zero position, a zero switch which is normally open but closed when the drum is turned from zero position, a notching magnet, a notching pawl operated by said magnet for rotating said drum tooth by tooth to bring the operating finger to a selected position, a holding pawl, a delay solenoid energized when said zero switch is closed, a normally open delay switch closed when said delay solenoid is energized for an appreciable length of time greater than the notching impulses required for the notching mechanism, an operating solenoid energized when said delay switch is closed for moving said drum and operating finger axially past a series of train control devices disposed radially about the drum in order to operate a selected one of said devices, said axial movement being large enough to move said drum past said notching and holding pawls, whereupon said resilient means restores said drum rotatively to zero position, following which the resulting opening of the zero switch deenergizes the operating solenoid so that said resilient means restores said drum axially to initial position.

21. In a remote control system for toy trains, a circuit including a source of current, a track, a stationary trackside dial transmitter and a train carried receiver responsive to impulses caused by said dial transmitter, said transmitter including a rotatable dial provided with finger holes, a spring for restoring said dial to zero position, a dog on said dial, a ratchet wheel driven by said dog during restoring movement of the dial, a cam turned by said ratchet wheel, and an electric switch in said circuit intermittently actuated by the teeth of said cam, said train-carried receiver including a rotatable and axially movable toothed member, a notching magnet, a pawl moved by said magnet for rotating said member tooth by tooth to one of a plurality of selected positions determined by the number of impulses transmitted from the dial transmitter, means, controlled by said transmitter when said member has reached said selected position, for axially moving said member, and independent circuit controlling means operable by said axial movement of said member, one for each said selected position.

22. A toy electric train having a train-carried driving motor, a train-carried switch for said motor, a plurality of train-carried accessories, a train-carried control switch for each of said accessories, and a train-carried selector means including means responsive to momentary current interruptions to select the particular switch to be operated and means to operate the particular switch selected, in order to selectively operate any one of the train-carried switches independently of all of the other train-carried switches, and a single source of power supply feeding a single kind of power over a single circuit to said train for said motor, for all of said accessories, for all of said switches, for said selector and for said means, the momentary interruptions during the selecting period being of insufficient duration to seriously affect the operation of the motor.

23. A toy electric train having a train-carried driving motor, a train-carried reversing switch for said motor, a train-carried speed control switch for said motor, a train-carried lamp, a train-carried control switch for said lamp, a train-carried audible signal, a train-carried control switch for said signal, and a train-carried selector means including means responsive to momentary current interruptions to select the particular switch to be operated and means to operate the particular switch selected, in order to selectively operate any one of the train-carried switches independently of all of the other train-carried switches, and a single source of power supply feeding a single kind of power over a single circuit to said train for said motor, lamp, signal, all of said switches, said selector and means, the momentary interruptions during the selecting period being of insufficient duration to seriously affect the operation of the motor.

24. A toy electric train having a train-carried driving motor, a train-carried switch for said motor, a plurality of train-carried accessories, a train-carried control switch for each of said accessories, and a train-carried selector means including a physically movable switch-operating element, means responsive to momentary current interruptions to physically move the movable element differing amounts or distances in order to select one or another of the switches, means to move said element in another direction for mechanically throwing the selected switch whereby any one of the train-carried switches may be operated independently of all of the other train-carried switches, and a single source of power supply feeding a single kind of power over a single circuit to said train for said motor, for all of said accessories, for all of said switches, for said selector and said means, the momentary interruptions during the selecting period being of

insufficient duration to seriously affect the operation of the motor.

25. A toy electric train supplied with and responsive to a single kind of power, said train having a train-carried driving motor, a train-carried switch for said motor, a plurality of train-carried accessories, a train-carried control switch for each of said accessories, and a train-carried selector means including means to select the particular switch to be operated and means to operate the particular switch selected in order to selectively operate any one of the train-carried switches independently of all of the other train-carried switches, said motor, accessories and switches all operating in response to the regular propulsion power supply of the train, and said selector operating in response to momentary interruptions in said power supply, the momentary interruptions during the selecting period being of insufficient duration to seriously affect the operation of the motor.

26. A remotely controlled electric toy railroad system comprising a standard track having service rails and a power rail, a propulsion power source for said track, a manually operable stationary remote control transmision device to produce momentary interruptions in the supply of propulsion power to said track, a toy train operable on said track and having a train-carried driving motor responsive to said propulsion power, a train-carried switch for said motor, a train-carried accessory responsive to said propulsion power, a train-carried control switch for said accessory, and a train-carried selector means including means to select the particular switch to be operated and means to operate the particular switch selected in order to selectively operate one of the train-carried switches independently of the other train-carried switch, in response to momentary interruptions of the aforesaid propulsion power supply to the aforesaid power rail, produced by said stationary remote control transmission device, the momentary interruptions during the selecting period being of insufficient duration to seriously affect the operation of the motor.

27. A remotely controlled electric toy railroad system comprising a standard track having service rails and a power rail, a propulsion power source for said track, a manually operable stationary remote control transmission device to produce momentary interruptions in the supply of propulsion power to the power rail, a toy train operable on said track and having a train-carried driving motor responsive to said propulsion power, a train-carried switch for said motor, a plurality of train-carried accessories adapted to be operated by the aforesaid regular propulsion current from the power rail, a train-carried control switch for each of said accessories, and a train-carried selector means including means to select the particular switch to be operated and means to operate the particular switch selected in order to selectively operate any one of the train-carried switches independently of all of the other train-carried switches, in response to momentary interruptions of the aforesaid propulsion power supply to the aforesaid power rail, produced by said stationary remote control transmission device, the momentary interruptions during the selecting period being of insufficient duration to seriously affect the operation of the motor.

28. A remotely controlled toy electric railroad system comprising a standard track having service rails and a power rail, a propulsion power source for said track, a manually operable stationary remote control transmission device to produce momentary interruptions in the supply of propulsion power to said track, a toy train operable on said track and having a train-carried driving motor responsive to said propulsion power, a train-carried reversing switch for said motor, a train-carried lamp responsive to said propulsion power, a train-carried control switch for said lamp, a train-carried audible signal responsive to said propulsion power, a train-carried control switch for said signal, and a train-carried selector means including means to select the particular switch to be operated and means to operate the particular switch selected in order to selectively operate any one of the train-carried switches independently of all of the other train-carried switches, in response to momentary interruptions of the aforesaid propulsion power supply to the aforesaid power rail, produced by said stationary remote control transmission device, the momentary interruptions during the selecting period being of insufficient duration to seriously affect the operation of the motor.

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