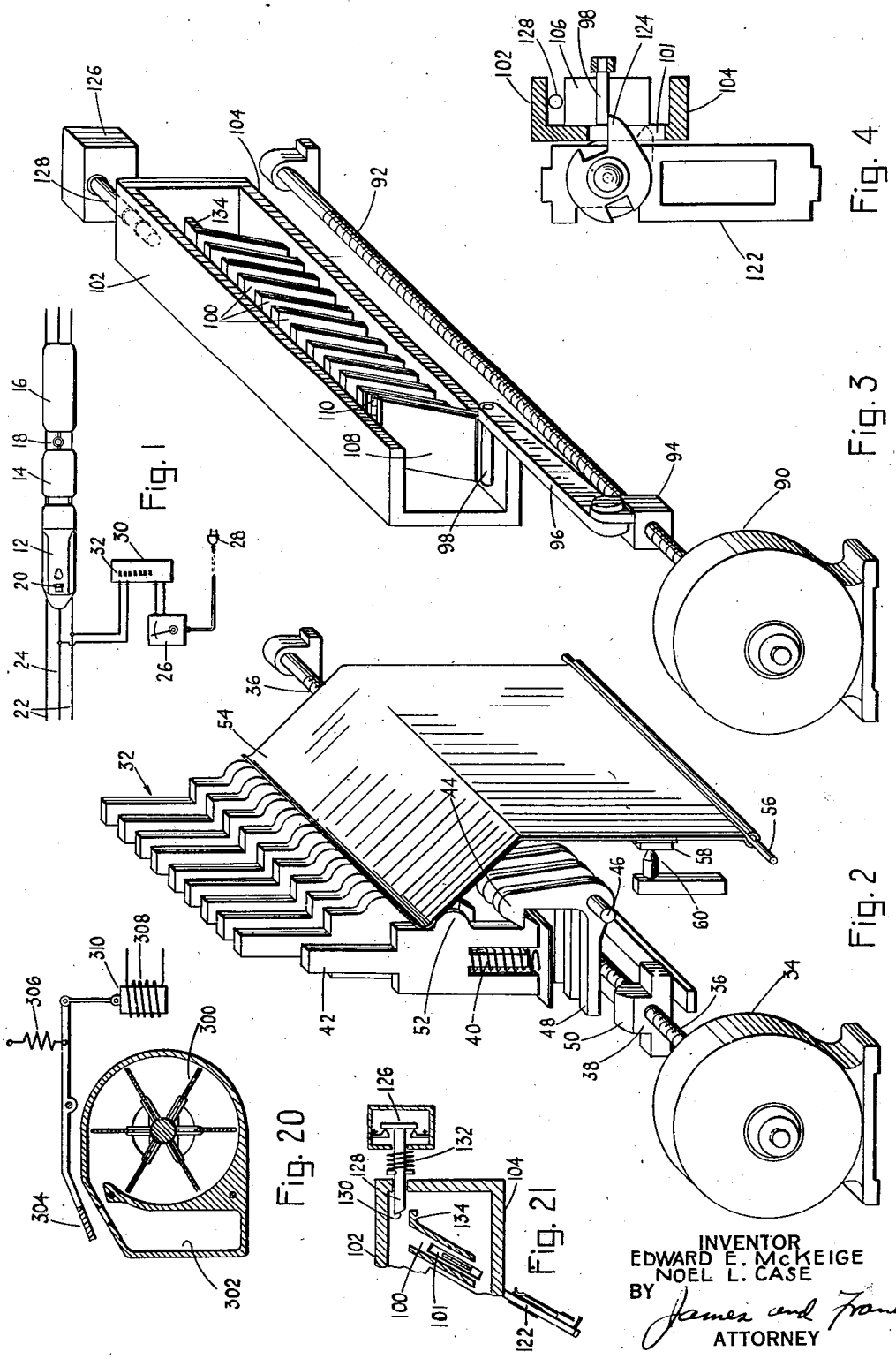
March 31, 1942. E. E. McKEIGE ET AL 2,278,358

REMOTE CONTROL SYSTEM FOR TOYS

Filed Dec. 13, 1939 3 Sheets-Sheet 1



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Filed Dec. 13, 1939 3 Sheets-Sheet 2

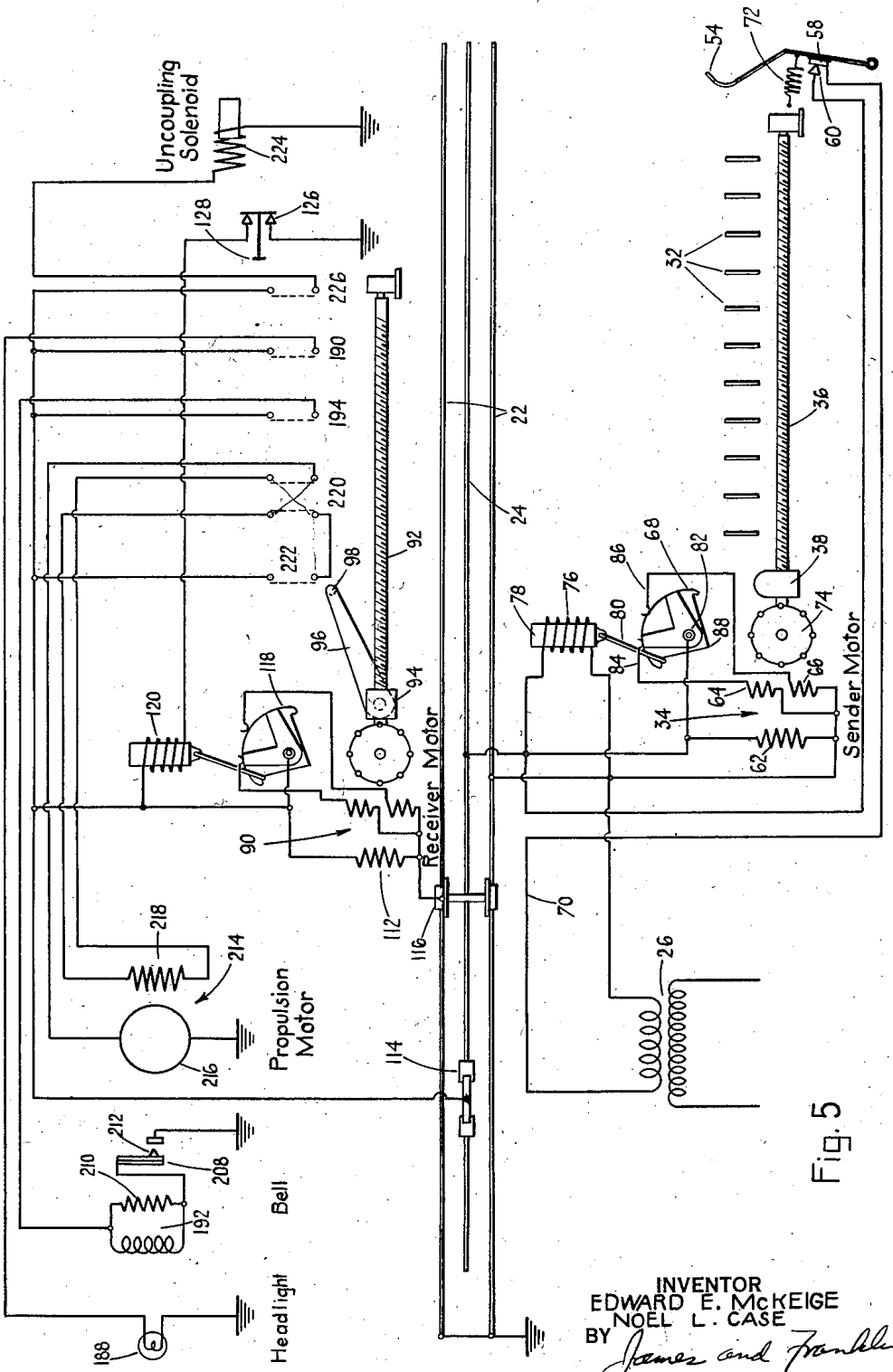

Fig. 5

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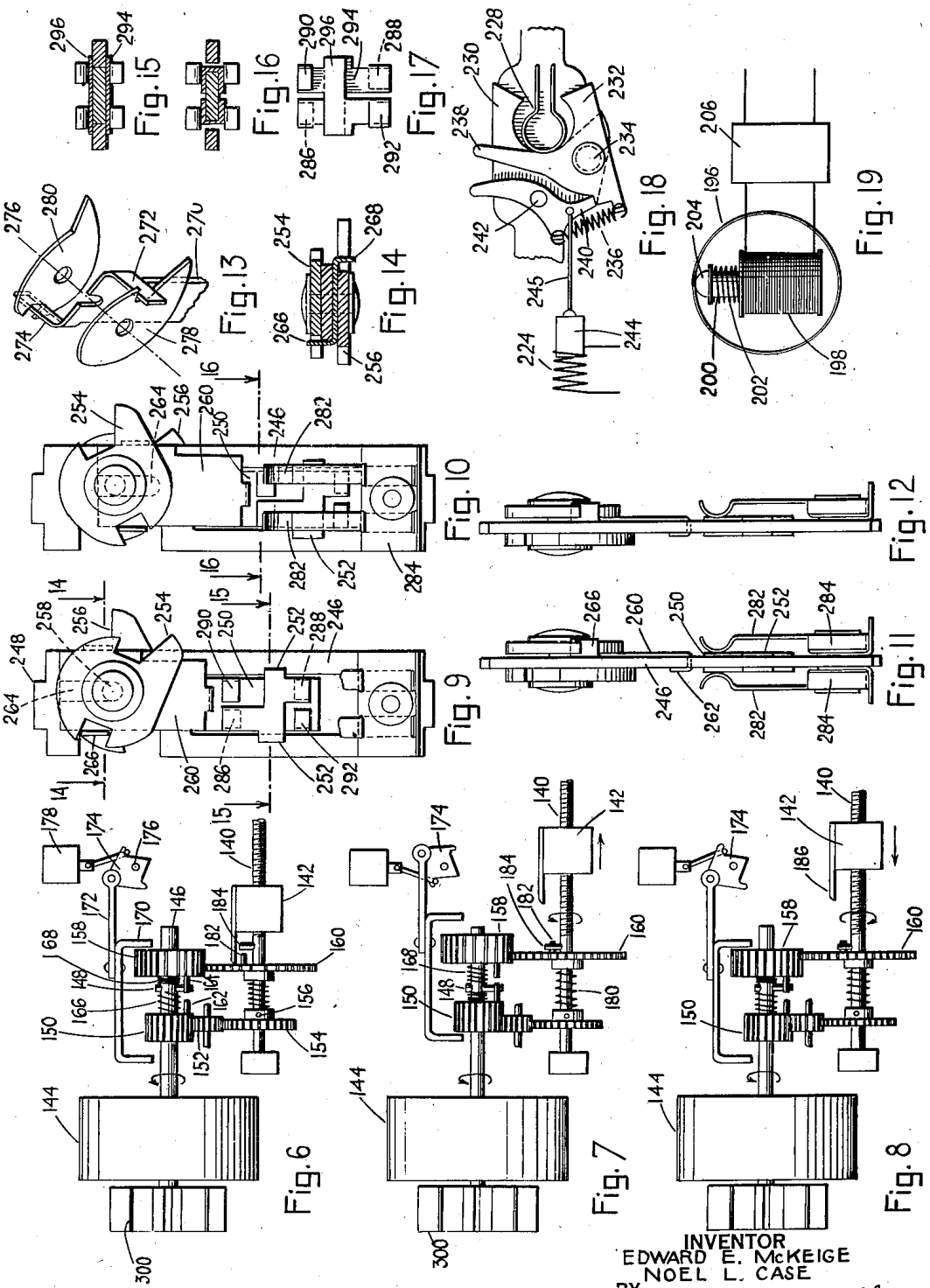

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2,278,358

REMOTE CONTROL SYSTEM FOR TOYS

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Application December 13, 1939, Serial No. 308,924

21 Claims. (Cl. 104—150)

This invention relates to remote control systems, especially for toys, and particularly for toy trains.

The primary object of our invention is to generally improve remote control systems for controlling a plurality of operations in a toy. The invention is disclosed as applied to a toy train system, and is intended to afford remote control of various train functions, such as the starting, stopping and direction of operation of the train, the turning on or off of the lights on the train, the operation of an audible signal such as a bell or whistle or both, and the operation of the coupling means between the locomotive and train drawn thereby. To accomplish any one of the foregoing functions is comparatively easy, but to control all of these functions in any desired combination while maintaining complete independence of control for each of the functions, is very difficult. This difficulty is increased by the fact that in accordance with another feature and object of the present invention, the control is obtained by means of the regular propulsion current, or in other words, through a simple two-wire feed system, without necessitating extra control wires or extra control current of differentiated character. For example, there is no superposition of direct current on alternating current or vice versa, and the track current is the only current that is used for signalling.

A system which successfully accomplishes the foregoing objects is disclosed in our co-pending application Serial Number 202,187, filed April 15, 1938, and entitled "Remote control system for toys." In that system, the control is obtained by means of a dial at the transmitter which interrupts the current supply a number of times dependent upon which of the control functions is desired. When dealing with a large number of control functions, this leads to a large number of interruptions of the propulsion current. This may slow up the movement of the train, and may cause an unnatural and conspicuously observable continued blinking of the lights. One primary object of the present invention is to overcome the foregoing difficulty, and to improve upon the aforesaid train control system by minimizing the necessary interruptions in the propulsion current. With this object in view, we control all functions by means of only two momentary interruptions, the selection of the particular function being determined by the spacing or time interval between the two interruptions.

The time interval is determined at the sender and is measured at the receiver. In accordance with a further feature and object of the invention, the necessary time intervals are established at both the sender and receiver by using similar synchronous motors and varying the permitted number of revolutions of the motors, this, of course, being directly related to time. The first of the two impulses initiates a movement in one direction or so-called outward movement under drive of the motor, while the second impulse terminates the outward movement and initiates a reverse or return movement to the home position. The extent of movement at the sender and receiver may be made the same, and may be used to select any desired one of a group of control functions.

Another object of our invention is to provide suitable structure for practicing the foregoing method. A more detailed object is to provide for the contingency of a single accidental interruption in the supply of propulsion current. This causes an outward movement which, however, is automatically rectified.

Train-carried whistles frequently employ a motor-driven blower. A further object of the present invention is to make it possible to drive a whistle by means of the aforementioned synchronous motor forming a part of the receiver, thus dispensing with the need for a separate additional motor for the whistle.

To the accomplishment of the foregoing and other objects which will hereinafter appear, our invention consists in the remote control system and the elements thereof 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 schematic diagram of a part of a toy railway embodying our invention;

Fig. 2 is a perspective view explanatory of the construction of the sender or transmitter;

Fig. 3 is a perspective view explanatory of the construction of the receiver;

Fig. 4 is a transverse section through a part of the receiver;

Fig. 5 is a wiring diagram showing the wiring at the sender and receiver;

Fig. 6 illustrates a modified construction using forward and backward running gearing, and showing the same in neutral position;

Fig. 7 shows the same in forward-running position;

Fig. 8 shows the same in backward-running position;

Fig. 9 is a front elevation of a motor-reversing switch which may be used at the receiver;

Fig. 10 shows the same in opposite position;

Fig. 11 is a side elevation of the same;

Fig. 12 is a side elevation of a modified switch for simply opening or closing the circuit;

Fig. 13 is explanatory of the operation of the switches;

Fig. 14 is a transverse section through a switch taken in the plane of the line 14—14 of Fig. 9;

Fig. 15 is a transverse section through the reversing switch taken in the plane of the line 15—15 of Fig. 9;

Fig. 16 is another transverse section through the reversing switch taken in the plane of the line 16—16 of Fig. 10;

Fig. 17 illustrates the metal parts of the slide of the switch with the insulation slide removed;

Fig. 18 is explanatory of the uncoupling mechanism;

Fig. 19 is explanatory of the bell-ringing mechanism;

Fig. 20 is explanatory of a locomotive whistle which may be advantageously used with one form of our invention; and

Fig. 21 illustrates a detail.

Referring to the drawings, and more particularly to Fig. 1, the remote control mechanism is shown applied to a toy train. This train comprises a locomotive 12 and simulated tender 14 pulling a train of cars, only the first car 16 of which is shown. The locomotive tender 14 is coupled to the train at 18 by a special coupling means adapted to be uncoupled under remote control, as will later appear. The locomotive is provided with a headlight 20, and this and other lights on the train may be remotely controlled. The starting, stopping and reversing of the train may be remotely controlled, as well as other train functions, as will hereinafter appear. The train operates on a conventional track system made up of service rails 22 and a power rail 24. The track system is energized by a conventional step-down transformer 26, which may be connected to an ordinary household lighting system by means of a plug 28.

The output of transformer 26, instead of being connected directly to the track, runs through a sender or control panel 30. This has a row of buttons generally designated 32, and the panel may be marked adjacent each button with the appropriate train function controlled by that button. It is merely necessary to depress a button in order to produce the desired change in the operation of the train. The desired remote control takes place through the regular propulsion current, and is based upon the use of a pair of momentary interruptions produced at the sender 30 with a properly predetermined spacing or time interval between the two interruptions. The receiver which responds to this signal is associated with the locomotive 12, which is ordinarily most conveniently done by locating the sender in the tender 14.

Referring now to Fig. 2 of the drawings, the sender comprises a synchronous motor 34 driving a long threaded rod or screw 36 carrying a nut 38. The buttons 32 are vertically reciprocable and are normally elevated by compression springs 40. When a button, in this case the button 42, is depressed, it is latched in down position by a suitable latch or detent 44. The row of detents 44 is pivoted on a pin 46, and each detent has an arm 48 overlying screw 36. The upper part of nut 38 is rounded or cam-shaped as shown at 50, and is thereby adapted to run beneath the arms 48, elevating the same as it moves along. Thus the nut 38 will release a depressed button when it reaches the detent of that button.

Each button is provided with a cam projection 52 arranged to cooperate with a plate 54 pivoted at 56 and having a switch contact 58 normally resting against a stationary contact 60. It will be evident that as a button is depressed, the projection 52 cams plate 54 outwardly and thereby opens contacts 58, 60. The projection 52 is then located below the cam follower portion of plate 54, and consequently, when the button is released, the plate 54 is again moved outwardly and the contacts 58, 60 are again opened.

Referring now to Fig. 5, the wiring below track 22 represents the wiring at the sender, and the wiring above track 22 represents the wiring on the train. The motor 34 is a shaded pole induction motor of the reversing type, it having a main field coil 62 and shading coils 64 and 66, one or the other of which is energized depending upon the position of a tumbler switch 68. Power is obtained from transformer 26 and is fed to the power rail 24 through a conductor 70 having the normally closed contacts 58, 60 in series with it. These contacts are controlled by plate 54 and are normally closed by spring 72. The opposite side of the transformer secondary is connected to the service rails 22. The main field coil 62 of the motor is connected in shunt with the track circuit, and is constantly energized. The motor is so designed that it may remain continuously in circuit even with the armature 74 locked against rotation, as it is when the nut 38 reaches its return or home position at the inner or left-hand end of screw 36.

A normally energized solenoid 76 is also connected in shunt with the track circuit and its core 78 is connected to a link 80, the lower end of which underlies the tumbler 68. The latter is pivoted at 82 and adapted to oscillate between the right-hand position shown in which contact finger 84 and coil 64 are energized, and the left-hand position in which contact finger 86 and coil 66 are energized. The tumbler 68 is so shaped that when in the right-hand position as shown, its point 88 is moved to the left of the axis of the tumbler and solenoid. Consequently, when solenoid 76 is deenergized and core 78 with link 80 falls, the lower end of the link hangs freely in a position on the right side of point 88 so that when solenoid 76 is again energized, the link slides up the right-hand side of the tumbler and then pulls the tumbler to its left-hand position. Thus each momentary interruption of the current supply shifts the tumbler to its opposite position and consequently reverses the motor 34.

In Fig. 5 the buttons are schematically symbolized by the bars 32. The nut 38 is normally in home position, and the motor 34 is energized in a direction tending to move the nut beyond its home position, which it cannot do, the nut being positively stopped by the end of the thread or by the provision of a suitable collar at the inner end of the screw. When a button is depressed, the power supply is momentarily interrupted at the contacts 58, 60, and the tumbler 68 and consequently motor 34 are reversed, thereby causing the screw 36 to move the nut 38 outwardly on the screw. When the nut reaches that button which has been depressed, it releases the button, and the upward movement of the

latter momentarily opens the power supply at contacts 58, 60, thus again reversing the tumbler switch and the motor 34, and thereby moving the nut 38 in return direction to its home position. Inasmuch as the motor 34 is a synchronous motor of predetermined speed, the time interval between the two interruptions of current depends on which button is depressed, it varying directly as the distance between the home position of nut 38 and the button which is depressed.

Referring now to Fig. 3, the receiver comprises a similar motor 90, that is, a reversible synchronous motor which is adapted to remain in circuit while its armature is locked. Motor 90 drives a screw 92 for moving a nut 94. The nut 94 carries a pivoted arm 96 and a stud 98. The latter is adapted to cooperate with a series of sloping passages or channels 100 defined by walls which terminate short of top and bottom walls 102 and 104, as is best shown by wall 106 in Fig. 4. A sloping deflector 108 is provided at the beginning of the series of channels 100. As here illustrated, the deflector 108 is hinged at 110, and its lower edge rests on bottom wall 104. It will be understood that a yieldable or springy deflector may be used instead of a hinged deflector.

During outward movement of nut 94, the stud 98 is guided upwardly by deflector 108 and then moves along beneath upper wall 102. During return or inward movement of nut 94, the stud 98 is drawn through one of the channels 100 until it reaches the bottom wall 104, and is then drawn along bottom wall 104 until nut 94 reaches its home position, at which time stud 98 has passed deflector 108, the latter rising to permit passage of the stud. Which of the channels 100 receives the stud 98 depends on how far outward the nut 94 has moved before the motor 90 is reversed to return the nut.

Reverting now to Fig. 5, the motor 90 has its main field coil 112 connected continuously in circuit between a power rail shoe or trolley 114 and the train wheels 116. A tumbler reversing switch 118 is associated with motor 90 and is controlled by a normally continuously energized solenoid 120, just as was previously described for the sender motor. The screw 92, nut 94, arm 96 and stud 98 are all schematically shown on the wiring diagram. It will be evident that the first power supply interruption starts outward movement of nut 94, and that the second interruption reverses motor 90 and starts the return movement of nut 94. The distance travelled by nut 94 depends on the time interval between the two interruptions, and is therefore directly related to which of the control buttons 32 has been depressed at the transmitter. The stud 98 may thus be used to actuate any one of a series of switches or to otherwise produce any desired control function.

Reverting now to Fig. 3, each channel 100 corresponds to one of the transmitter buttons. A row of switches is disposed in back of the channels, but these switches have been omitted in Fig. 3. Referring to Figs. 4 and 21, it will be noted that there is a slot 101 at the base of each channel 100. An electric switch, shown schematically, and generally designated 122, is mounted between each pair of the aforesaid slots 101, that is, the switch is mounted behind an adjacent pair of the channels 100. The switch is controlled by a pair of arms or cams 124, one of which is disposed on each side of the switch. These cams pass through the slots 101 and are movable between the solid line and dotted line positions shown in Fig. 4. In the solid line position the cam projects into the channel and is so disposed as to lie in the path of the stud 98 and is thereby adapted to be moved by the stud as the stud is drawn through the channel.

The cams are preferably so related that one is moved upward when the other is pulled downward, and vice versa. A specific form of switch construction is described later, but for the present, it is sufficient to state that a cam 124 is pulled downwardly by the stud until it is moved into the slot, as is indicated by the dotted line position in Fig. 4. The stud continues through the channel and is brought back to home position. The resulting change in switch position also moves the other cam upwardly from the dotted line position of Fig. 4 to the solid line position, so that the switch can again be changed by moving the stud through the adjacent channel.

The receiver is preferably provided with means to take care of the contingency of the power supply to the track or train being accidentally interrupted a single time only. In such case, the nut 94 and stud 98 move outward, and we accordingly provide means to return them to home position at the end of their outward movement. Referring to Figs. 3 and 21, a switch 126 is normally closed but may be opened by depression or longitudinal movement of a pin 128 projecting into the channel box. When stud 98 is moved outward beyond all of the channels 100, it bears against stud 128 and opens the switch. The sloping end 130 on pin 128 causes the stud to move downward off the end of the pin, permitting the switch 126 to again close, under pressure of spring 132. A ledge 134 prevents premature escape of the stud from the end of pin 128.

Referring now to Fig. 5, the normally closed switch 126 is shown to be connected in series with the solenoid 120. When stud 98 depresses and then releases pin 128, the switch 126 is opened and again closed. This reverses the motor, and the nut 94 moves back to home position.

A modified form of drive for the screw is illustrated in Figs. 6, 7 and 8. The screw 140 there shown may be either the sender or receiver screw. The nut 142 may be either the camming nut at the sender or the stud-carrying nut at the receiver. One advantage of the modified drive is that the screw is reversed by mechanical gearing so that the motor 144 may be a simple unidirectional motor. Furthermore, although the motor runs continuously, it idles when not in use, instead of being locked against its own power drive. Another advantage is that the motor may be used to drive a locomotive whistle, as will be later described.

The motor 144 drives a shaft 146 carrying a pin 148. The forward-running gear train comprises a pinion 150 meshing with an idler 152 which in turn drives a gear 154 pinned to screw 140 at 156. The backward-running gear train consists of a pinion 158 meshing with a gear 160 which is freely rotatable on the screw. The pinions 150 and 158 are both freely rotatable on shaft 146 except when clutched to the shaft by means of pin 148. For this purpose, the pinions have inwardly projecting pins 162 and 164. These pins normally seek disengagement from drive pin 148 by small compression springs 166 and 168.

The pinions 150 and 158 are axially movable on shaft 146, and their movement is controlled by a yoke 170 connected by link 172 to a tumbler 174 which is pivoted at 176 and actuated by a

normally energized solenoid 178. It may be pointed out that solenoid 178 corresponds to the solenoids 76 and 120 (Fig. 5) previously described, and tumbler 174 corresponds to the tumblers 68 and 118 previously described, but in the present case the movement of the tumbler is employed for mechanical gear-shifting purposes instead of for electrical switching.

In Fig. 6 the nut 142 is shown in its home position, and while pinion 158 is clutched to shaft 146 it drives only gear 160 which at this time is idle and freely rotatable on screw 140. In Fig. 7 the tumbler 174 has been reversed by a first interruption of the current supply. This shifts pinion 150 into engagement with drive pin 148 and at the same time pinion 158 is moved out of engagement by its spring 168. Pinion 150 rotates screw 140 in the forward direction, and nut 142 moves outward, as shown. Incidentally, the outward movement of the nut permits a compression spring 180 to move gear 160 axially until its pin 182 engages a pin 184 on screw 140.

When the second interruption of the current supply takes place, the tumbler 174 is again reversed, thereby disengaging pinion 150 and engaging the backward-running pinion 158. This causes a reverse rotation of screw 140, and nut 142 returns toward its home position. When it reaches home position, a finger 186 on nut 142 shifts gear 160 axially, as is shown in Fig. 6, thereby disengaging the gear from the screw and permitting the motor 144 to idle.

Reverting now to Fig. 5, and particularly the upper portion thereof, representing the wiring on the train, the lamp 188 is a headlight for the locomotive, but the same or a separate lamp circuit may be provided for lights in the cars of the train. This lamp circuit is controlled by a switch 190. A bell circuit is indicated at 192, this circuit being controlled by a switch 194. The bell is shown in Fig. 19, it comprising a gong 196 housing a solenoid 198, the core 200 of which is normally elevated by spring 202. When solenoid 198 is energized, the hammer 204 is drawn downwardly, and when the solenoid is deenergized, the hammer is struck upwardly against the inside of the gong 196. In order to produce well-spaced, deliberate action of the bell, a thermostatic switch may be used, this being schematically illustrated by rectangle 206. Reverting to Fig. 5, the bimetallic bar of the thermostatic switch is shown at 208, it being heated by a resistor 210. As the bar 208 is repeatedly heated and cooled, the circuit is opened and closed at contacts 212. These contacts are normally closed when the thermostat is cold so that in order to bring the circuit into operation, it is merely necessary to close the main bell switch 194.

The propulsion motor of the locomotive is shown at 214, it preferably being a series motor having an armature 216 and field 218. The armature and field connections are brought to a reversing switch 220. This comprises four contacts which when bridged vertically as shown, drive the motor in one direction, and when bridged horizontally instead of vertically, drive the motor in opposite direction. The operation of the motor, that is, the starting and stopping of the motor, is controlled by a switch 222. In the present disclosure, no means has been shown for controlling the speed of the train. This is readily accomplished by the provision of appropriate additional switches for connecting a speed-controlling resistor in series with the propulsion motor. A suitable switch for this purpose is disclosed in our co-pending application Serial Number 202,187, previously referred to.

Other train control functions may be provided. In the present case, a train uncoupling solenoid 224 is provided, the circuit of this solenoid being controlled by a switch 226. Referring to Fig. 18, the coupling comprises a male element having an approximately cylindrical upstanding element 228 received between the jaws 230 and 232 of a female element. The male element is larger than the space between the jaws when the jaws are closed, as shown. Jaw 232 is pivoted at 234 and normally moves to open position under the influence of a spring 236. The jaws are closed when male element 228 bears against an arm 238 projecting sidewardly from jaw 232. This takes place when two cars are run together with the part 228 bearing against the arm 238, as shown in Fig. 18. The jaws are then held in closed position by a latch 240 pivoted at 242. When the train uncoupling solenoid 224 is energized, it attracts core 244 and this is connected by a suitable link 245 to latch 240, thereby releasing the latch and so opening the coupling. The jaw arrangement is disclosed in Rexford Patent No. 2,157,187, issued May 9, 1939, but the method of control of the latch is different in the present case.

Coming now to the switches, we shall first describe the direction reversing switch 220. As was stated in connection with Fig. 5, there are four contacts, and when these are joined one way, say, in a vertical direction, the locomotive will run forward. If, however, the contacts are joined in another way, say, in a horizontal direction, 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 shown in Figs. 9, 10 and 11 of the drawings, which show one specific structure for the reversing switch. The switch comprises a strip of insulation 246 the ends of which are reduced and shouldered at 248 to form tenons which are received in mating slots in support walls, not shown. Insulation strip 246 is cut away at the middle to form a slot or frame in which a slider 250 is slidable. This slider may be a strip of insulation of the same thickness as frame 246. It is provided on its opposite sides with contact plates having outwardly projecting guides 252. 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 254 and 256 pivotally mounted on opposite sides of frame 246 by means of a pin 258. A link 260 made of a thin piece of sheet metal connects slider 250 and the cams 254, 256. One end of link 260 is provided with a tongue 262 (Fig. 11) which is received in a slot in the slider. The opposite end of link 260 underlies cam 254 and is slotted at 264 (Figs. 9 and 10) to straddle the pin 258. Link 260 is provided with a lug 266 bent toward one side to engage the cam 254, and another lug 268 bent toward the opposite side to engage the cam 256 (Fig. 14). It will be observed that the lugs 266 and 268 are disposed on opposite sides of pin 258. Hence, they are moved in opposite directions by the cams. Specifically, in Fig. 9, the slider 250 is nearest the cams (upward), it having been moved there by a pull in the opposite direction (downward) on cam 254. This operating movement of cam 254 was transmitted through lug 266 and was accompanied by an opposite or restoring movement of cam 256 caused by lug 268.

This movement may be explained by reference

to the more rudimentary showing in Fig. 13, in which it will be seen that a link 270 is provided with oppositely bent lugs 272 and 274, these being disposed on opposite sides of the axis 276 of cams 278 and 280. The parts are in position for operation on cam 280, and when cam 280 is drawn down by the stud, it produces an upward movement of link 270 and that upward movement causes an upward or restoring movement of cam 278 by reason of the lug 274. Thus, the downward movement of cam 280 is accompanied by an upward movement of cam 278, and cam 278 is restored to initial position ready to be operated upon by the stud. When it is operated on and drawn downwardly, the parts assume the position shown in Fig. 13, and, at this time, the cam 280 is again brought upward ready to be operated upon by the stud.

Reverting now to Figs. 10 and 11, the frame 246 carries four contact springs 282, the movable ends of which bear against the slider 250, and the stationary ends of which are insulatedly secured to the switch frame 246 by blocks of insulation 284. These four contact springs correspond to the four contacts indicated at 220 in Fig. 5.

The slider 250 carries metallic contact plates. In Fig. 9, the contact springs 282 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 plates are bent around the edge of the slider onto the opposite face, as is indicated at 286 and 288. The contact plate on the opposite side is similar, but reversed in position, and its reversely bent lugs are indicated at 290 and 292. The construction may be clarified by reference to Fig. 17 in which the two contact plates are shown with the insulation slider removed from between the same. The upwardly and inwardly bent parts 290 and 292 are formed integrally with the bottom or remote contact plate 294. The parts 286 and 288 are bent downwardly and inwardly from the upper contact plate 296.

In Fig. 9, 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 252. The situation is then as shown in Fig. 15, in which it will be seen that the upper contact springs are directly connected by the top contact plate 296, while the bottom contact springs are connected by the bottom contact plate 294. This corresponds to one position of the reversing switch 220 in Figs. 5. In Figs. 10 and 11, 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. 16, 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 other switch position at 220 in Fig. 5, and results in reversing the motor, and, consequently, the locomotive.

In Fig. 5 it will be seen that most of the switches may be of the simple on-and-off type. A switch for this purpose is shown in Fig. 12, and the principal change is the omission of two of the spring contacts 282. Figs. 9 and 10 may be considered front elevations of the switch shown in Fig. 12, 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 296, 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. 10. From an electrical viewpoint, the rear contact plate 294 may be omitted, but it is retained for structural reasons, in order to provide the four outwardly projecting guides 252 which retain and guide the slider 250 in the switch frame.

It will be understood that the switches just described correspond to that shown at 122 in Fig. 4, in which the slide portion of the switch has been omitted. The switches are preferably disposed at an angle as is shown in Fig. 21, so that the cams will move longitudinally of the sloping channels 100.

It has already been mentioned that the mechanical reversing arrangement of Figs. 6, 7 and 8 has the advantage of providing a whistle without using a special whistle-driving motor. Referring to Fig. 20, the whistle comprises a fan or bladed wheel 300 which rotates in a casing leading to a whistle or sound resonating chamber 302. The whistle is controlled by a valve 304 normally held closed by a spring 306. The valve may be pulled open against the action of spring 306, as shown, by a solenoid 308 acting on a core 310. When solenoid 308 is energized the core is pulled downwardly; the valve is moved upwardly, and the whistle blows. With this type of control the fan 300 may run continuously.

Referring now to Figs. 6, 7 and 8, the fan 300 is mounted on the shaft of the continuously running synchronous motor 144.

Referring now to Fig. 5, it will be understood that the whistle-controlling solenoid may be connected in circuit much as was described for the other train control devices. For example, the whistle-controlling solenoid may replace the bell 192 in Fig. 5, or it may replace the uncoupling solenoid 224, or another switch may be added if it is desired to provide the whistle in addition to the bell and the uncoupling solenoid. This will necessitate the addition of two channels in the receiver and the addition of two control buttons on the sender, one button marked "Whistle on," and the other "Whistle off," or equivalent identification.

In connection with Fig. 5 it will be understood that the wiring at the synchronous motors is simplified when using the mechanical reversing arrangement of Figs. 6, 7 and 8. It is believed that a separate diagram would be superfluous, and it may therefore be stated, for the sake of completeness, that the motors will have the fields 62 and 112 permanently connected in circuit, and that the reversing switch connections at tumblers 68 and 118 with their associated reversing shade coils, may be omitted. Instead, the tumblers are mechanically connected to gears, as was previously explained. The motors run continuously and in one direction only.

It is believed that the construction and operation as well as the advantages of our improved train control system will be apparent from the foregoing detailed description thereof. Any desired button is depressed at the sender. This causes a first momentary interruption in the current supply, which reverses the tumblers, and so starts the motors (referring to the first form of the invention using reversing motors) at the sender and receiver. The nuts move outwardly. When nut 50 at the sender reaches the depressed

button, it releases the latch and the button, and a second momentary interruption of the current supply takes place. This again reverses the tumbler switches, thereby reversing the motors, and the nuts move back toward home position. At the receiver, the stud 98 is thereby drawn through a channel corresponding to that button which was depressed, and so reverses the position of the control switch or control device associated with that channel. For the most part, the buttons are used in pairs, one button corresponding to the closed position, and the other to the open position of a switch. When the nuts have moved back to home position, they mechanically stop the motors from further rotation.

In the case of the modified form of invention shown in Figs. 6 through 8, the only difference is that the reversing of the tumbler shifts the gears and thereby changes the direction of movement of the nuts at the sender and receiver. When the nuts reach home position they disengage the gear 160 at the pins 182, 184 (Figs. 6 and 7), and the motor runs idle instead of being locked.

With our arrangement, any train control function may be obtained independently of any other function, and in any desired sequence, without necessitating more than two momentary interruptions of the current supply to the track system.

It will be understood that the particular train control functions shown were chosen solely by way of illustration and not in limitation of the invention. Any other desired train operation may be controlled by appropriately modifying the wiring at the receiver. Furthermore, the control system may be used on toys other than trains, although it is particularly valuable where the wiring or circuit between the sender and receiver is limited, as is the case with trains. It will therefore be apparent that while we have shown and described our invention in preferred forms, many changes and modifications may be made in the structures disclosed, without departing from the spirit of the invention as sought to be defined in the following claims.

We claim:

1. A remote control system for toys, said system comprising a sender and a receiver connected by an alternating current supply line, synchronous motors at said sender and receiver, movable mechanisms moved by said motors, an interrupter switch in said current supply line at the sender, a plurality of control buttons associated with the movable mechanism at the sender each arranged to momentarily open said interrupter switch and thereby interrupt the current supply, solenoid-operated starters to thereupon start said movable mechanisms under drive of said motors, means operated by the sender mechanism to again operate the interrupter switch after a time interval measured by the sender motor and dependent upon which of the control buttons is actuated, a plurality of controlled switches at the receiver, and an actuator driven by the synchronous motor at the receiver for selecting and actuating one of said switches, the selected one being dependent upon the time interval between the two interruptions of the current supply.

2. A remote control system for toys, said system comprising a sender and a receiver connected by an alternating current supply line extending between said sender and receiver, the sender including a synchronous motor, a screw driven thereby, a nut moved by said screw, a row of control buttons along the screw, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver, a solenoid-operated starter to thereupon start the screw under drive of the synchronous motor, and so start the nut moving along the screw until it reaches the said button, means whereby the nut releases the depressed button on reaching the same and again momentarily opens said interrupter switch to interrupt the current supply and reverses the screw so that the nut is screwed back to initial position.

3. A remote control system for toys, said system comprising a sender and a receiver connected by a current supply line extending between said sender and receiver, said receiver comprising a synchronous motor, a screw driven thereby, a nut movable on said screw, a pivoted arm and stud moved by said nut, a series of sloping guide channels, a deflector to initially guide the stud to one side of said channels during outward movement of the nut, said stud passing through one of said channels during return movement of the nut, means whereby a first interruption of current supply starts the nut moving in outward direction and a second interruption starts the nut moving in return direction, whereby the guide channel through which the stud is drawn corresponds to the time interval between interruptions, and a plurality of control devices distributed one for each channel and arranged to be actuated by said stud as it is drawn through a channel.

4. A remote control system for toys, said system comprising a sender and a receiver connected by an alternating current supply line, the sender including a synchronous motor, a screw driven thereby, a nut moved by said screw, means whereby momentary interruption of the current supply starts the screw under drive of the sender motor and so starts the nut moving along the screw until it reaches a desired point, means whereby the current supply on the line is again momentarily interrupted when the nut reaches the button, means whereby said second interruption reverses the screw and the nut is screwed back to initial position, said receiver comprising a synchronous motor, a screw driven thereby, a nut movable on said screw, means whereby the first interruption of current supply starts the screw under drive of the receiver motor and so starts the nut moving in outward direction, and means whereby the second interruption reverses the screw and starts the nut moving in return direction, and a plurality of control devices arranged to be actuated by said nut.

5. A remote control system for toys, said system comprising a sender and a receiver connected by an alternating current supply line, the sender including a synchronous motor, a screw driven thereby, a nut moved by said screw, a row of control buttons along the screw, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and starts the nut moving along the screw until it reaches the said button, means whereby the nut releases the depressed button on reaching the same and again momentarily opens said interrupter switch to interrupt the current supply and reverses the screw so that the nut is screwed back to initial

position, said receiver comprising a synchronous motor, a screw driven thereby, a nut movable on said screw, a pivoted arm and stud moved by said nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector to initially guide the stud to one side of said channels during outward movement of the nut, said stud passing through one of said channels during return movement of the nut, means whereby the first interruption of current supply starts the screw under drive of the receiver motor and so starts the nut moving in outward direction, and means whereby the second interruption reverses the screw and starts the nut moving in return direction, so that the guide channel through which the stud is drawn corresponds to the button depressed at the sender, and a plurality of control devices distributed one for each channel and arranged to be actuated by said stud as it is drawn through a channel.

6. A remotely controlled toy railway comprising a track system, a train, a trackside sender connected to the track system, and a receiver carried by the train and connected to the track system and so to the sender, synchronous motors at said sender and receiver, movable mechanisms moved by said motors, an interrupter switch in said current supply line at the sender, a plurality of control buttons associated with the movable mechanism at the sender adapted to momentarily open said interrupter switch and thereby interrupt the current supply, solenoid-operated starters to thereupon start said movable mechanisms under drive of said motors, means operated by the sender mechanism to again operate the interrupter switch after a time interval measured by the sender motor and dependent upon which of the control buttons is actuated, a plurality of train-control switches at the receiver, and an actuator driven by the synchronous motor at the receiver for selecting and actuating one of said switches to produce a desired train control function, the selected one being dependent upon the time interval between the two interruptions of the current supply.

7. A remotely controlled toy railway comprising a track system, a train, a trackside sender connected to the track system, and a receiver carried by the train and connected to the track system and so to the sender, the sender including a synchronous motor, a screw driven thereby, a nut moved by said screw, a row of control buttons extending along the screw, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the track and the receiver, a solenoid-operated starter to thereupon start the screw under drive of the synchronous motor, and so start the nut moving along the screw until it reaches the said button, means whereby the nut releases the depressed button on reaching the same and again momentarily opens said interrupter switch to interrupt the current supply and reverses the screw so that the nut is screwed back to initial position.

8. A remotely controlled toy railway comprising a track system, a train, a trackside sender connected to the track system, and a receiver carried by the train and connected to the track system and so to the sender, said receiver comprising a synchronous motor, a screw driven thereby, a nut movable on said screw, a pivoted arm and stud moved by said nut, a series of sloping guide channels, a deflector at the beginning of said series to initially guide the stud to one side of said channels during outward movement of the nut, said stud passing through one of said channels during return movement of the nut, means whereby a first interruption of current supply starts the nut moving in outward direction and a second interruption starts the nut moving in return direction, whereby the guide channel through which the stud is drawn corresponds to the time interval between interruptions, and a plurality of train control devices distributed one for each channel and arranged to be actuated by said stud for controlling the operation of the train.

9. A remotely controlled toy railway comprising a track system, a train, a trackside sender connected to the track system, and a receiver carried by the train and connected to the track system and so to the sender, the sender including a synchronous motor, a screw driven thereby, a nut moved by said screw, means whereby momentary interruption of the current supply starts the screw under drive of the sender motor and so starts the nut moving along the screw until it reaches a desired point, means whereby the current supply on the line is again momentarily interrupted when the nut reaches the said desired point, means whereby said second interruption reverses the screw and the nut is screwed back to initial position, said receiver comprising a synchronous motor, a screw driven thereby, a nut movable on said screw, means whereby the first interruption of current supply starts the screw under drive of the receiver motor and so starts the nut moving in outward direction, and means whereby the second interruption reverses the screw and starts the nut moving in return direction, and a plurality of train-control devices arranged to be selectively actuated by said nut depending upon the point of reversal for controlling the operation of the train.

10. A remotely controlled toy railway comprising a track system, a train, a trackside sender connected to the track system by a current supply line, and a receiver carried by the train and connected to the track system and so to the sender, the sender including a synchronous motor, a screw driven thereby, a nut moved by said screw, a row of control buttons extending along the screw, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and starts the nut moving along the screw until it reaches the said button, means whereby the nut releases the depressed button on reaching the same and again momentarily opens said interrupter switch to interrupt the current supply and reverses the screw so that the nut is screwed back to initial position, said receiver comprising a synchronous motor, a screw driven thereby, a nut movable on said screw, a pivoted arm and stud moved by said nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of said channels during outward movement of the nut, means effective on reverse movement of the nut, to guide said stud through the channel last passed in its outward movement, means whereby the first interruption of current supply starts the screw under drive of the receiver motor and so starts the nut moving in outward direction, and means whereby the second interruption reverses the screw and starts the nut moving in return

direction, so that the guide channel through which the stud is drawn corresponds to the button depressed at the sender, and a plurality of train control devices distributed one for each channel and arranged to be actuated by said stud for controlling the operation of the train.

11. A toy control means comprising a sender and a remote receiver connected thereto by a current supply line, the sender and receiver each including a reversible shaded pole induction motor, a screw driven thereby, a nut moved by the screw, a solenoid-operated reversing switch for controlling the direction of rotation of the motor, said motor being adapted to remain stalled with the current on, a row of control buttons extending along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the solenoid-operated reversing switch at both sender and receiver and so starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply, so that both reversing switches and motors are reversed and the nuts are screwed back to initial position, and means to block the nuts at initial position.

12. A toy control means comprising a sender and a remote receiver connected thereto by a current supply line, the sender and receiver each including a reversible shaded pole induction motor, a screw driven thereby, a nut moved by the screw, a solenoid-operated reversing switch for controlling the direction of rotation of the motor, said motor being adapted to remain stalled with the current on, a row of control buttons extending along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the solenoid-operated reversing switch at both sender and receiver, and so starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply, so that both reversing switches and motors are reversed and the nuts are screwed back to initial position, means to block the nut at initial position, a pivoted arm and stud moved by the receiver nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of the channels during outward movement of the nut, means effective on reverse movement of the nut, to guide said stud through the channel last passed in its outward movement, the said guide channel corresponding to the button depressed at the sender, and a plurality of control devices distributed one for each channel and arranged to be actuated by said stud.

13. A toy railway comprising a track system, a train, a trackside sender connected to the track system by a current supply line, and a receiver carried by the train and connected to the track system and so to the sender, the sender and receiver each including a reversible shaded pole induction motor, a screw driven thereby, a nut moved by the screw, a solenoid-operated reversing switch for controlling the direction of rotation of the motor, said motor being adapted to remain stalled with the current on, a row of control buttons extending along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the solenoid-operated reversing switch at both sender and receiver, and so starts the nuts moving outwardly on the screws; means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply, so that both reversing switches and motors are reversed and the nuts are screwed back to initial position, means to block the nuts at initial position, a pivoted arm and stud moved by the receiver nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of the channels during outward movement of the nut, said stud passing through one of the channels during return movement of the nut, the guide channel corresponding to the button depressed at the sender, and a plurality of train-control devices distributed one for each channel and arranged to be actuated by said stud for controlling the operation of the train.

14. A toy train control means comprising a sender, and a remote receiver connected thereto by a current supply line, the sender and receiver each including a reversible shaded pole induction motor, a screw driven thereby, a nut moved by the screw, a solenoid operated reversing switch for controlling the direction of rotation of the motor, said motor being adapted to remain stalled with the current on, a row of control buttons extending along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the solenoid-operated reversing switch at both sender and receiver and starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply, so that both reversing switches and motors are reversed and the nuts are screwed back to initial position, means to block the nuts at initial position, a pivoted arm and stud moved by the receiver nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of the channels during outward movement of the nut, means effective on reverse movement of the nut, to guide said stud through the channel last passed in its outward movement, the guide channel corresponding to the button depressed at the sender, a plurality of control devices distributed one for each channel and arranged to be actuated by said stud for controlling the operation of the train, and means for causing return of the receiver nut without passing through any of said channels in the event of a single interruption only of the current supply.

15. A toy control means comprising a sender connected to a receiver through a current supply line, the sender and receiver each including a constantly running synchronous motor, a screw, a nut moved by the screw, forward running gearing and backward running gearing between said

motor and screw, said gears being normally in neutral or idle position, a solenoid-operated shifter for controlling the gearing to engage either the forward or backward running gears, and means on said nuts to disengage the backward running gearing when the nut is returned to home position, a row of control buttons along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the shifter at both sender and receiver and starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply so that both shifters and drive gears are reversed and the nuts are screwed back to initial position.

16. A toy control means comprising a sender connected to a receiver through a current supply line, the sender and receiver each including a constantly running synchronous motor, a screw, a nut moved by the screw, forward running gearing and backward running gearing between said motor and screw, said gears being normally in neutral or idle position, a solenoid-operated shifter for controlling the gearing to engage either the forward or back running gears, and means on said nuts to disengage the backward running gearing when the nut is returned to home position, a row of control buttons along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the shifter at both sender and receiver and starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply so that both shifters and drive gears are reversed and the nuts are screwed back to initial position, a pivoted arm and stud moved by the receiver nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of the channels during outward movement of the nut, means effective on reverse movement of the nut, to guide said stud through the channel last passed in its outward movement, said channel corresponding to the button depressed at the sender, and a plurality of control devices distributed one for each channel and arranged to be actuated by said stud.

17. A toy railway comprising a track system, a train, a trackside sender connected to the track system by a current supply line, and a receiver carried by the train and connected to the track system and so to the sender, the sender and receiver each including a constantly running synchronous motor, a screw, a nut moved by the screw, forward running gearing and backward running gearing between said motor and screw, said gears being normally in neutral or idle position, a solenoid-operated shifter for controlling the gearing to engage either the forward or backward running gears, and means on said nuts to disengage the backward running gearing when the nut is returned to home position, a row of control buttons extending along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the shifter at both sender and receiver and starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply so that both shifters and drive gears are reversed and the nuts are screwed back to initial position, a pivoted arm and stud moved by the receiver nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of the channels during outward movement of the nut, means effective on reverse movement of the nut, to guide said stud through the channel last passed in its outward movement, said channel corresponding to the button depressed at the sender, and a plurality of train-control devices distributed one for each channel and arranged to be actuated by said stud for controlling the operation of the train.

18. A toy railway comprising a track system, a train, a trackside sender connected to the track system by a current supply line, and a receiver carried by the train and connected to the track system and so to the sender, the sender and receiver each including a constantly running synchronous motor, a screw, a nut moved by the screw, forward running gearing and backward running gearing between said motor and screw, said gears being normally in neutral or idle position, a solenoid-operated shifter for controlling the gearing to engage either the forward or backward running gears, and means on said nuts to disengage the backward running gearing when the nut is returned to home position, a row of control buttons extending along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the shifter at both sender and receiver and starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply so that both shifters and drive gears are reversed and the nuts are screwed back to initial position, a pivoted arm and stud moved by the receiver nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of the channels during outward movement of the nut, means effective on reverse movement of the nut, to guide said stud through the channel last passed in its outward movement, said channel corresponding to the button depressed at the sender, and a plurality of train-control devices distributed one for each channel and arranged to be actuated by said stud for controlling the operation of the train, a train whistle including a blower driven by said constantly running motor, and valve means for controlling sound production by said whistle, one of said train-control devices being arranged to control said valve means.

19. A toy control means comprising a sender, and a remote receiver connected thereto through a current supply line, the sender and receiver each including a constantly running synchronous

motor, a screw, a nut moved by the screw, forward running gearing and backward running gearing between said motor and screw, said gears being normally in neutral or idle position, a solenoid-operated shifter for controlling the gearing to engage either the forward or backward running gears, and means on said nuts to disengage the backward running gearing when the nut is returned to home position, a row of control buttons extending along the screw at the sender, an interrupter switch in said current supply line, means whereby depression of any button momentarily opens said interrupter switch and interrupts current supply to the receiver and so reverses the shifter at both sender and receiver and starts the nuts moving outwardly on the screws, means whereby the sender nut on reaching the depressed button releases the button and again momentarily opens said interrupter switch to interrupt the current supply so that both shifters and drive gears are reversed and the nuts are screwed back to initial position, a pivoted arm and stud moved by the receiver nut, a series of sloping guide channels corresponding to the buttons at the sender, a deflector at the beginning of said series to initially guide the stud to one side of the channels during outward movement of the nut, means effective on reverse movement of the nut, to guide said stud through the channel last passed in its outward movement, said channel corresponding to the button depressed at the sender, and a plurality of control devices distributed one for each channel and arranged to be actuated by said stud, and means for causing return of the nut at the receiver without said stud passing through said channels in the event of a single interruption only of the current supply.

20. A remote control system for a toy, said system comprising a sender connected to a receiver, a movable element at the sender a synchronous motor to move the same, a movable element at the receiver, a synchronous motor to move the same, a main propulsion current connection between the sender and receiver for operating the entire toy, and means responsive to two spaced interruptions of the current supply to simultaneously start both movable elements in motion under the influence of their synchronous motors and to simultaneously arrest and reverse their movement back to home position, whereby the distance moved by the movable element at the receiver is directly responsive to and dependent upon the distance moved by the movable element at the sender.

21. A remote control system for a toy, said system comprising a sender connected to a receiver, a movable element at the sender, a synchronous motor to move the same, a movable element at the receiver, a synchronous motor to move the same, a main propulsion current connection between the sender and receiver for operating the entire toy, and means responsive to two spaced interruptions of the current supply to simultaneously start both movable elements in motion under the influence of their synchronous motors and to simultaneously arrest and reverse their movement back to home position, whereby the distance moved by the movable element at the receiver is directly responsive to and dependent upon the distance moved by the movable element at the sender, means at the sender to determine the extent of movement of the movable element, and means at the receiver to control the operation of the toy in accordance with any one of a plurality of functions dependent upon the extent of movement of the movable element.

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