Dec. 23, 1952 J. L. BONANNO 2,622,542

ELECTRONIC CONTROL FOR TOY ELECTRIC RAILROADS

Filed Oct. 11, 1947 3 Sheets-Sheet 1

Fig. 7.

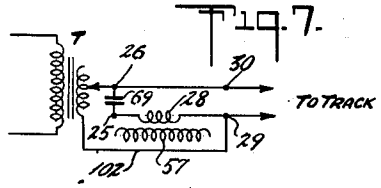


Fig. 1.

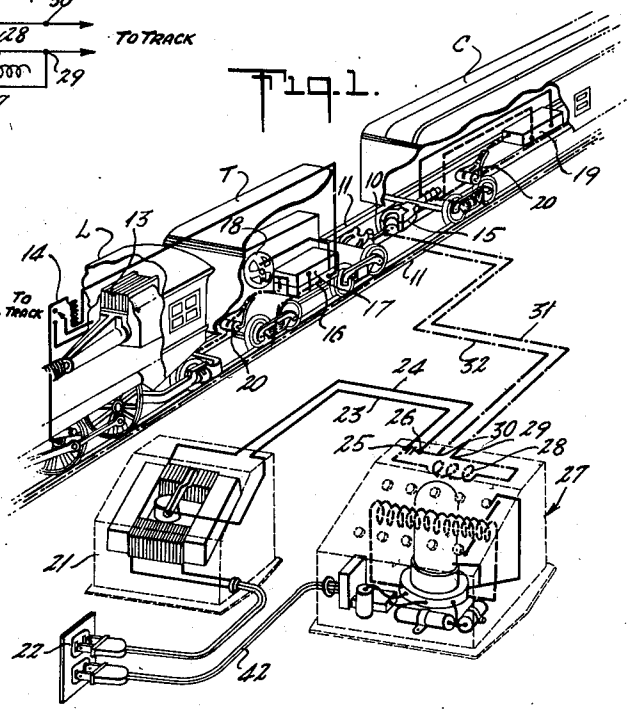


Fig. 8.

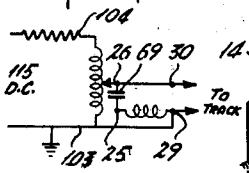
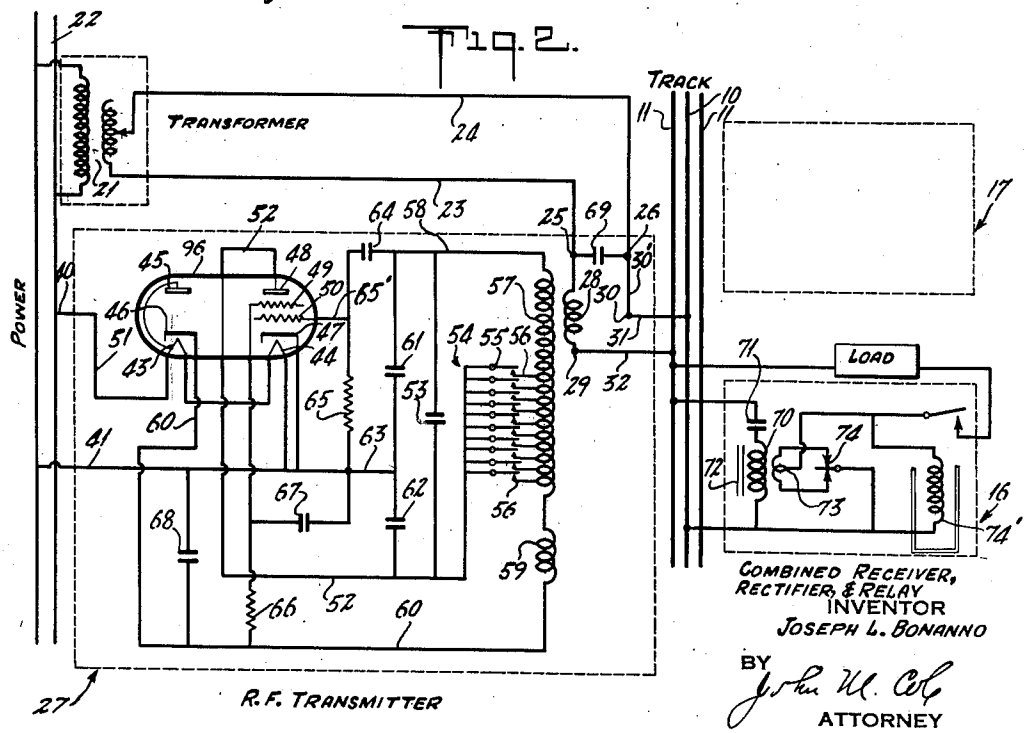


Fig. 2.



COMBINED RECEIVER, RECTIFIER, & RELAY

INVENTOR
JOSEPH L. BONANNO

BY
John M. Cobb
ATTORNEY

Dec. 23, 1952 J. L. BONANNO 2,622,542

ELECTRONIC CONTROL FOR TOY ELECTRIC RAILROADS

Filed Oct. 11, 1947 3 Sheets-Sheet 2

Fig. 3.

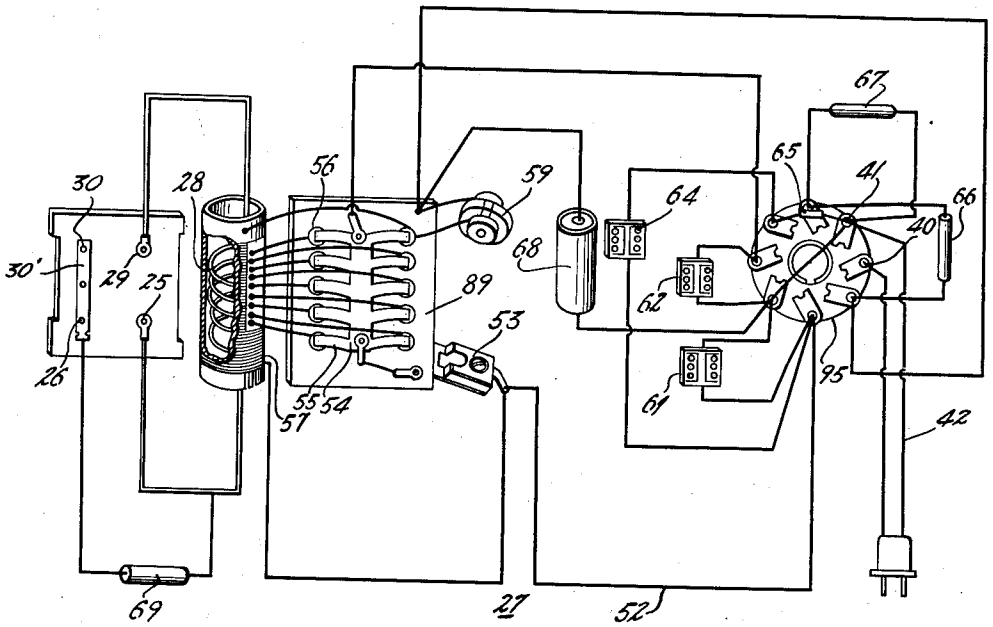
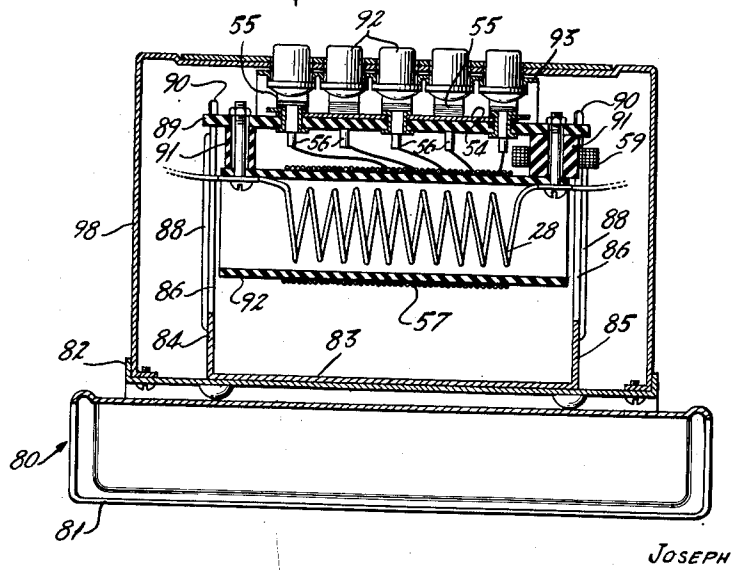


Fig. 6.



INVENTOR.
JOSEPH L. BONANNO
BY
John M. Cobb
ATTORNEY

Dec. 23, 1952 J. L. BONANNO 2,622,542

ELECTRONIC CONTROL FOR TOY ELECTRIC RAILROADS

Filed Oct. 11, 1947 3 Sheets-Sheet 3

Fig. 4.

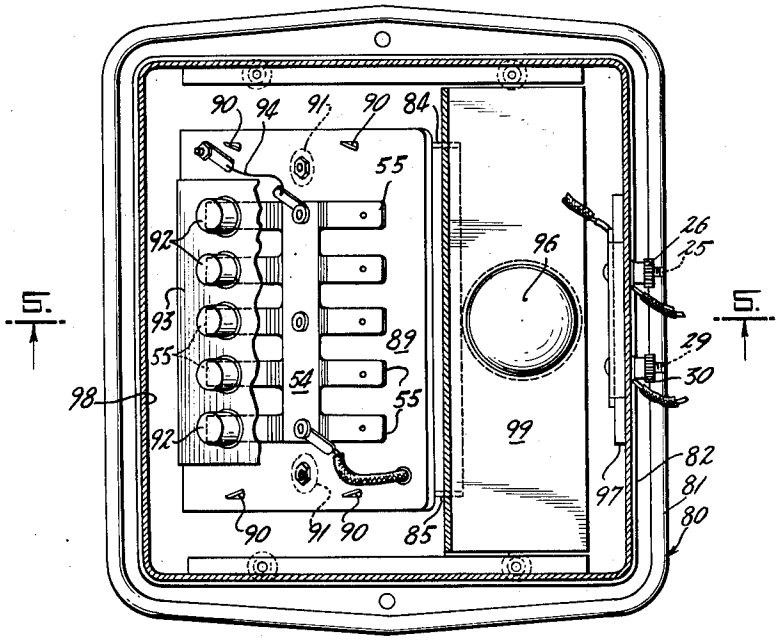
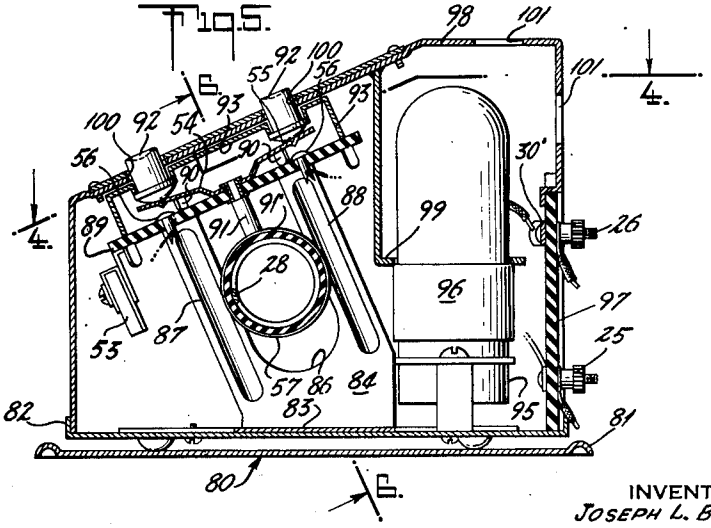


Fig. 5.



INVENTOR
JOSEPH L. BONANNO

BY John M. Cobb
ATTORNEY

Patented Dec. 23, 1952

2,622,542

UNITED STATES PATENT OFFICE

2,622,542

ELECTRONIC CONTROL FOR TOY ELECTRIC RAILROADS

Joseph L. Bonanno, Madison, N. J., assignor to The Lionel Corporation, New York, N. Y., a corporation of New York

Application October 11, 1947, Serial No. 779,273

5 Claims. (Cl. 104—150)

1

The present invention relates to electronic controls and is more particularly directed toward controls for use in toy electric railroads.

Toy electric railroads are operated at comparatively low voltages of from 8 to 25 volts supplied either through the current reducer for direct current operation or through a transformer for alternating current operation. Two wires are used from the source of supply to the track circuit for providing propulsion current for the locomotive, current for the lights and current for operating train carried accessories such as locomotive reversing switches, whistle motors, couplers, car unloading mechanism and the like, as well as track side accessories such as lamps and track switches.

Controls for these devices have generally been effected through such expedients as the use of superposed rectified current on the alternating power supply, the use of specially equipped track sections adapted to cooperate with specially equipped cars, or the use of direct wire connections, for example, to track switches.

The present invention contemplates an electronic control system according to which the control currents of high or radio frequency are superimposed on the propulsion circuit, whether the same be an alternating current or a direct current circuit. In the latter case care has to be taken to maintain polarity relations.

According to the present invention the power supply is connected to an electronic oscillator with tuned circuits of selected frequencies and the output of the oscillator is impressed upon the lower voltage supply circuit for the track layout so that the high frequency current circulates through the track circuit, there being receivers suitably disposed in relation to various accesseries and load circuits of the train and track layout which are individually pre-tuned to the frequencies available from the oscillator. This makes it possible to interconnect the electronic transmitter with the usual track circuit and operate the train and accessories entirely through electronic controls. The speed of the train is usually controlled by varying the voltage supplied to the track circuit.

The accompanying drawings show, for purposes of illustrating the present invention, an embodiment in which the invention may take form, together with modified wiring diagrams, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In these drawings,

2

Figure 1 is a diagrammatic view illustrating the relation of train, track, track circuit, transformer and electronic controller;

Figure 2 is a wiring diagram illustrating the entire system, the oscillator output coil being in series with the track power supply;

Figure 3 is a wiring diagram for the electronic transmitter, the structural parts being diagrammatically illustrated;

Figure 4 is a top plan view showing the structure of a controller with parts in section along the line 4—4 of Figure 5;

Figure 5 is a vertical, sectional view on the line 5—5 of Figure 4;

Figure 6 is a section on the line 6—6 of Figure 5; and

Figures 7 and 8 show modified wiring diagrams in which the oscillator output is in parallel with the transformer, Figure 7 being for an A. C. circuit and Figure 8 for a D. C. circuit.

In Figure 1 a fragment of a toy track layout is shown, the center or power rail being at 10 and the return or wheel bearing rails at 11—11. The rolling stock as shown includes a locomotive L, tender T and car C. The locomotive has the usual motor 13 and reversing switch 14. The tender and car are connected together by electromagnetic couplers 15. The tender carries two receivers 16 and 17, the receiver 16 being adapted to control the reversing switch 14 while the receiver 17 controls the motor for the whistle indicated at 18. The car C carries a receiver 19 adapted to control the energizing circuit from the coupler 15. These receivers are connected to the third rail through rollers indicated at 20.

The propulsion current circuit includes a variable voltage stepdown transformer 21 connected to the power supply wires 22 and having an output circuit whose wires 23 and 24 are connected to terminals 25 and 26 of a radio frequency transmitter designated generally by the reference character 27. Where a D. C. source is employed one uses a current reducer such as shown in Figure 8 and connects to the radio frequency transmitter in the same way as the transformer. This radio frequency transmitter has an output coil 28 composed of a few turns of heavy copper wire which in the circuit of Figure 2 is connected in series between terminal 25 and an output terminal 29. The terminal 26 of the controller 27 is connected by a strap 30' to an output terminal 30. The terminals 29 and 30 of the radio frequency transmitter are connected by wires 31 and 32 with the center and grounded rails respectively of the track layout.

The radio frequency transmitter 27 has input terminals 40 and 41 adapted to be connected to the power supply 22 usually through a lamp cord 42 as indicated. The transmitter is here shown as provided with a diode-pentode vacuum tube having two filaments 43 and 44 connected between the terminals 40 and 41. The filament 43 cooperates with an anode 45 and cathode 46 of a diode section, while the filament 44 cooperates with a cathode 47 and anode 48 and two grids 49 and 50 respectively of a pentode section. The anode 45 of the diode section is connected to the filament as indicated at 51. The anode 48 of the pentode section is connected by a wire indicated at 52 with one side of a trimmer condenser 53 and with a metal plate 54 having a plurality of resilient fingers 55 adapted to be brought into engagement with contacts 56 connected to a plurality of taps carried by a tank coil 57. One end of the tank coil 57 is connected to the trimmer condenser 53 by a wire indicated at 58, while the other end of the tank coil 57 is connected through a radio frequency choke 59 and wire 60 with the cathode 46 of the diode section. Two condensers 61 and 62 are in series with one another and in parallel with the trimmer condenser and the three condensers act as an adjustable capacity across the tank coil. These condensers are connected to the filament circuit by a wire indicated at 63, the condenser 61 is shunted by a condenser 64 and resistance 65 connected to the control grid 50 by a wire 65'. The screen grid 49 is connected to the radio frequency choke lead 60 through a resistance 66 and to the cathode 47 and filament circuit through a condenser 67. A condenser 68 interconnects the filament 44 and cathode 47 with the choke lead 60. A condenser 69 is placed across the input terminals 25 and 26 to by-pass the radio frequency currents on the power side.

When the device is designed for operation on 60 cycle house current and employs a No. 117N7GT or 117P7GT tube, suitable values for the condensers, resistances, choke and tank coil are as follows:

Condenser 53_____	10–160 mfd.
Condenser 61_____	.005 mfd. ± 5%.
Condenser 62_____	.002 mfd. ± 5%.
Condenser 64_____	.001 mfd. ± 10%.
Condenser 67_____	.002 mfd. ± 10% 150–400 v.
Condenser 68_____	20–30 mfd. dry electrolytic 150 v.
Condenser 69_____	.1 mfd. paper 150–400 v.
Resistance 65_____	15 M ½ watt carbon resistor.
Resistance 66_____	15 M 1 watt carbon resistor.
Tank coil 57_____	165 turns.
Output coil 28____	5 turns.
Radio frequency choke 59.	80 ohms 7.5 mh.

With proper location of the taps in the coil it is possible to secure frequencies of from 240 to 360 kilocycles to be supplied the propulsion circuit and a selected frequency in this range is available when the desired button is depressed.

Receivers such as 15, 17 and 19, of Figure 1, have a wiring diagram such as shown in Figure 2. The units include a variable tuning device having coil 70, condenser 71 and adjustable core 72, a secondary coil 73 connected at its ends to a full wave rectifier 74 and at its mid point to relay coil 74', as more fully described and claimed in my applications Serial No. 719,811, filed January 2, 1947, now Patent Number 2,581,165, dated January 1, 1952; Serial Nos. 771,447

to 771,449, filed August 30, 1947, now Patent Numbers 2,526,453 to 2,526,455, respectively, all dated October 15, 1950.

The structural embodiment of the electronic controller shown in the drawings is in the form of a comparatively small, totally enclosed unit having the lamp cord 42 for connection to the power supply and the terminals 25, 26, 29 and 30. The device has a base 80 made of two pieces 81 and 82 of sheet metal welded together, and a yoke or bracket 83 welded to the base and having upwardly bent ends 84 and 85 slotted as indicated at 86 to form bifurcations 87 and 88. The ends of these bifurcations are reduced, pass through holes in an insulating plate 89, and are twisted as indicated at 90 to secure the plate 89 in place.

The plate 89, through insulating posts 91, supports a tube 92 on which the tank coil 57 is wound. One of these posts supports the choke 59. The output coil 28 is secured to the tube and its ends connected to binding posts 25 and 29.

The plate 89 carries contact pins 56 connected by wires to the coil taps. It also carries the metal plate 54 with resilient fingers. These fingers are operated by push buttons 92 (appropriately colored) held in place by a retainer plate 93. The trimmer condenser 53 is secured to plate 89 and connected by wire with plate 54.

An 8-contact vacuum tube socket 95 is secured to the base to the rear of the coil and push buttons. This socket carries a diode-pentode tube 96. The condensers and resistances are wired in to the structure as indicated in Figure 3. The terminals 25, 26, 29 and 30 are secured to an insulating plate 97 and all the wiring parts are enclosed by a cover designated generally by the reference character 98. This cover has an apertured plate 99 through which the bulb of the vacuum tube extends. The cover is provided with openings 100 for the push buttons and with ventilation openings 101.

Instead of connecting the transformer and oscillator output coil in series as in Figures 2 and 3, they may be connected in parallel by shifting the transformer secondary connection from the binding post 25 to the binding post 29 as shown by wire 102 in Figure 7. This circuit has also been found satisfactory because of the high impedance of the transformer.

Figure 8 illustrates a parallel circuit arrangement for D. C. operation in which the wire 103 connects the grounded side of the current reducer 104 (such as shown in Caruso 1,697,412), and with the track. The inductively wound reducer connection employed in such current reducers have sufficiently high impedance to block radio frequency currents.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular form shown is but one of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. In a toy railroad system operable from the usual house current source of power supply, a track layout including a plurality of insulated rails for wheel support and current conduction, a voltage reducing device connected to one of the rails, a coil of comparatively few turns and adapted to form an oscillating current output coil and connected to the other rail and to the voltage

reducing device to transfer radio frequency currents to the same, a radio frequency transmitter connected to the source of power and having a multitapped oscillator tank coil inductively coupled to the first mentioned coil, a power operated oscillator supplying current to the tank coil, and connected to normally open switches one for each tap of the tank coil, and a train on the track having a plurality of electronic receivers each tuned to a frequency corresponding to that transmitted to the track by closing one of the switches, a normally open-circuit relay connected to one of the rails and operable by the receiver, and a low voltage, power operable device connected to the other rail and to the relay.

2. A system as claimed in claim 1, wherein the oscillator includes a diode and a pentode.

3. A system as claimed in claim 1, wherein the output coil is in series with the voltage reducing device and a track rail.

4. A system as claimed in claim 1, wherein the output coil is in parallel with the voltage reducing device and a track rail, and the voltage reducing device has radio frequency limiting impedance.

5. In combination, a toy railroad track, a track carried toy train having a plurality of current consuming devices each connected to one of the rails of the track, a plurality of normally open circuit relays each having one side connected to the other rail of the track and to the other side of the corresponding current consuming device,

a tuned electronic receiver operably connected to the coil of each relay and to the rails of the track, means to supply current to the tracks at a voltage substantially below house current voltage, a radio frequency transmitter with its input at house current voltage and including a rectifier, a vacuum tube oscillator, condensers, resistances, a multitap oscillator tank coil, tap selecting switches whereby a selected frequency may be generated in the tank coil and an oscillation output coil of few turns connected to the tracks to supply them with high frequency current for actuating a selected receiver and its relay and connecting the corresponding load to the track.

JOSEPH L. BONANNO.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,569,233	Morton	Jan. 12, 1936
2,073,443	Cardoza	Mar. 9, 1937
2,173,483	King	Sept. 19, 1939
2,378,326	Rees et al.	June 12, 1945
2,429,819	Jordan	Oct. 28, 1947
2,430,471	Land	Nov. 11, 1947

FOREIGN PATENTS

Number	Country	Date
820,714	France	Nov. 17, 1937