Jan. 9, 1968 J. R. WILHELM 3,363,109

MODEL RAILROAD ELECTRIC POWER SUPPLIES AND DISTRIBUTION EQUIPMENT

Filed Jan. 23, 1963 3 Sheets-Sheet 1

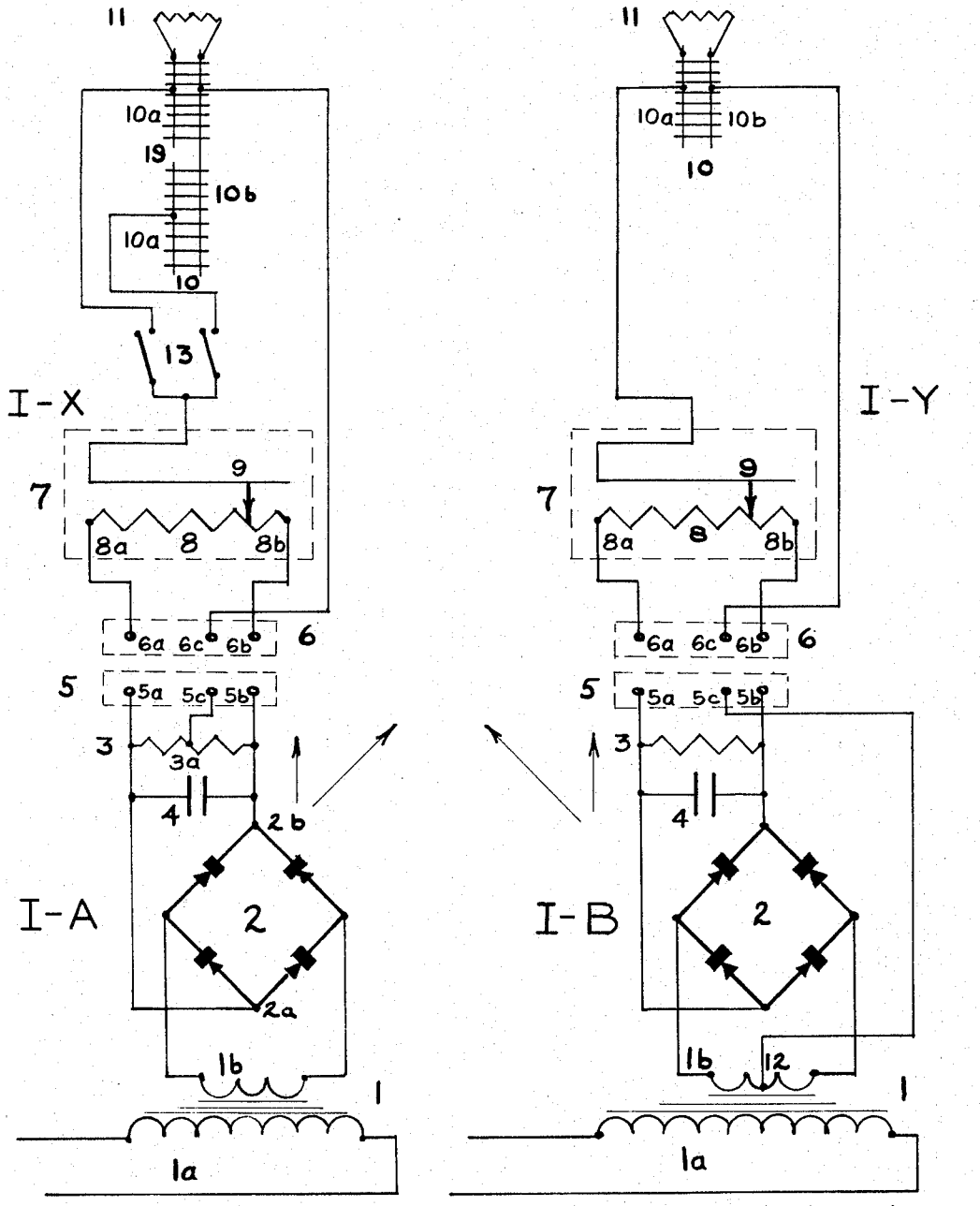


FIG. I

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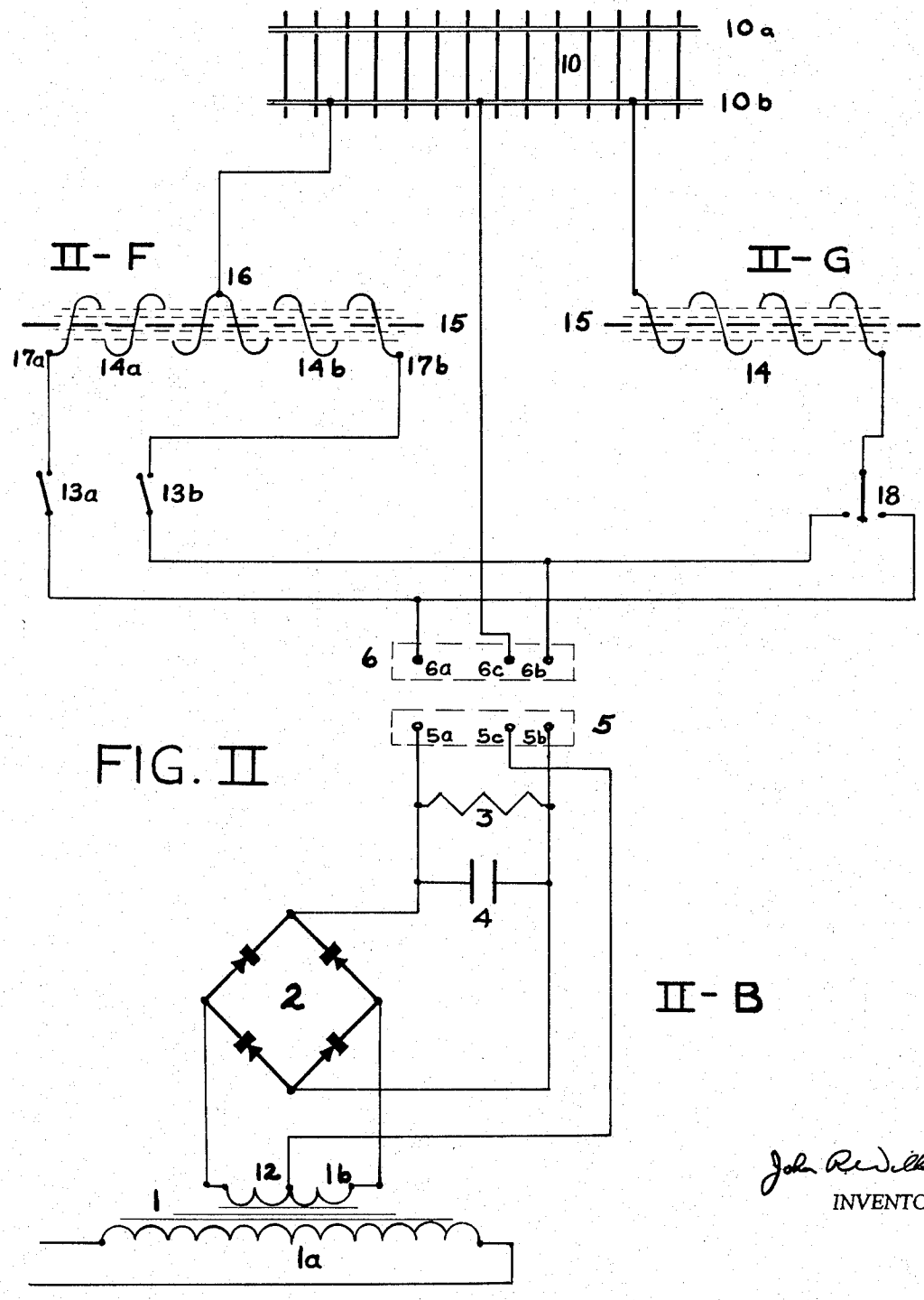


FIG. II

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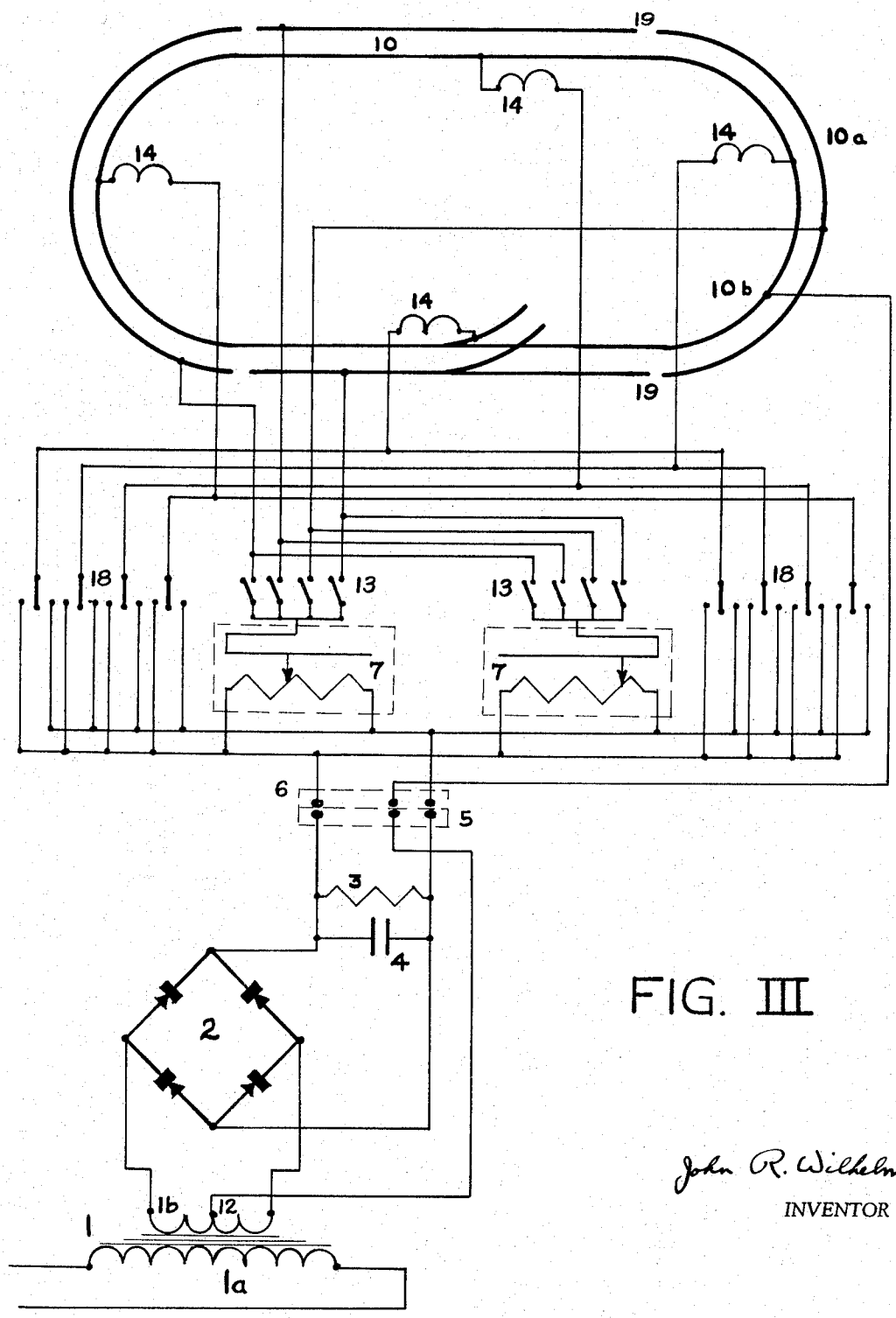


FIG. III

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3,363,109

MODEL RAILROAD ELECTRIC POWER SUPPLIES AND DISTRIBUTION EQUIPMENT

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7 Claims. (Cl. 307—12)

The basic object of my invention is to provide a unique electrical power supply for use with the conventional two rail, direct current powered toy train or other moving, track controlled toy or toys such that two or more locomotives or other toys can operate independently on the same track system. It provides a means whereby the current flow in electrically segmented portions of the power rail of the track system can be reversed thereby reversing the direction of movement of the locomotive without reversing the polarity of the entire power supply. In this manner two or more locomotives can be independently operated by individual control devices on the same, though electrically segmented, track system off of a common power supply.

It is another object of my invention to make it possible to operate train accessories with low voltage direct current power without electrically disrupting the functioning of the rest of the track layout or train operation.

It is a further object of my invention to make it possible for the actuating solenoid of train accessories requiring "one or the other" positioning to be operated in a more easily understood manner by the attachment of a single electrical lead to the solenoid using direct current as opposed to the conventional two wire connection using alternating current.

In FIGURE I, I show two wiring configurations by which the required direct current electrical power for use with toy electric trains or other toys can be derived from conventional house alternating current and two developments of a wiring technique which provide direction control of the current flow and distribute the electrical energy to single or multiple track sections. It is apparent that either of the proposed power supplies, designated I–A and I–B can be attached, as desired, to the potentiometer and distribution systems which are designated I–X and I–Y.

In FIGURE II, I show two variations of a means of electrical actuation of train accessories which are to be used with this power supply. Conventional power supplies for model railroading which use direct current for locomotion use alternating current for actuation of accessories and require separate wiring. One of the variations of this new concept uses two solenoids with opposed windings designated II–F while the other variation employs a single solenoid and requires only one electrical connection, designated FIGURE II-G. They are shown attached to the power supply illustrated in FIGURE I–B, here designated as II–B. It is intended to simplify the installation and make more complex track layouts easier to understand.

In FIGURE III, I show a typical track layout illustrating how this new power supply can be used to permit two or more individuals with their own potentiometers to independently control the direction of flow of electrical current in portions of the track layout and operate powered accessories without adversely affecting the activity of the other individual or individuals in the control of other track segments. It combines the disclosures of FIGURES I–B, I–X and II–G.

Referring to the drawings in greater detail, FIGURE I–A illustrates a step down transformer 1 with a primary coil 1*a* and a secondary coil 1*b* whose alternating current output is rectified in a conventionally constructed full wave rectifier 2 to a direct current voltage which is nominally twice the operating value of the toys being

operated. This direct current voltage is supplied to terminal elements 5*a* and 5*b* of an output receptacle 5. These terminal elements 5*a* and 5*b* are connected in electrical parallel with a high load resistance 3 and a capacitor 4 to the discharge points of the rectifier configuration 2, terminal element 5*b* being connected to discharge point 2*b* and terminal element 5*a* being connected to discharge point 2*a*. Load resistance 3 has a center tap 3*a* which is connected to a third terminal element 5*c* of the output receptacle 5. The output receptacle 5 is to be female in construction and is polarized in order that connection to it can be made in only one way.

Turning our attention to FIGURE I–Y in connection with FIGURE I–A, we have a male type polarized connector 6 constructed to mate with the power supply output receptacle 5 in the prescribed manner only. In similar manner it has three terminal elements 6*a*, 6*b*, and 6*c* which, when this connector 6 is mated with the output receptacle 5, make electrical connection with terminals 5*a*, 5*b*, and 5*c* respectively. Terminal element 6*a* is connected to one end 8*a* of the resistor 8 of potentiometer 7 while terminal element 6*b* is attached to the other end 8*b* of resistor 8. Thus, when connector 6 is mated with output receptacle 5, resistor 8, resistor 3, and capacitor 4 are all in electrical parallel across the output of the full wave rectifier 2.

The variable tap 9 of potentiometer 7 had the capability of movement from one extremity 8*a* of resistance 8 to the other extremity 8*b*. In tihs way it selects a voltage across the full range of the output of the rectifier 2 for transmittal to that rail of the toy track 10 which has been designated the power rail 10*a*.

The ground rail 10*b* of track 10 is connected without switching to the third terminal element 6*c* of the connector 6. Thus, when connection is made between connector 6 and output receptacle 5, the ground rail 10*b* of the track 10 is connected to the mid voltage point 3*a* of the load resistor 3 of the power supply. Thus, when the system is being operated, the ground rail 10*b* of the track 10 is held at the mid voltage point of the output of the power supply. When the variable tap 9 of potentiometer 7 is moved to position 8*a* on the potentiometer resistor 8, maximum current will flow outward to the power rail, thru the electrical load of the engine 11 operating between the track rails and back to the power supply thru the center tap 3*a*. The voltage will be equal to the full operating voltage of the train and full forward motion of the engine will ensue.

As the variable tap 9 is moved slowly to the opposite position 8*b* on resistance 8, outward current in the variable tap 9 will diminish and the speed of the engine 11 will be reduced. It will pass thru a no voltage point with respect to the ground rail 10*b* at which point no current will flow and the engine is at rest. Current will gradually increase as variable tap 9 continues to move toward point 8*b* but now inwardly from the power rail 10*a* toward potentiometer 7. As variable tap 9 reaches the other end 8*b* of the resistor 8, the voltage across the engine electrical load 11 is again equal to the full operating voltage of the train, reversed in polarity, and the engine is operating in a full reverse mode. The voltage polarity between the two rails of the track has been reversed without changing the polarity of the supply itself, a fact which is crucial if two or more engines are to be operated independently from the same power supply.

In FIGURE I, combining I–B and I–Y, we have an identical arrangement to that described in diagram I–A and I–Y except that the ground rail 10*b* is connected to a mid-point tap 12 on the secondary coil 1*b* of step down transformer 1 as opposed to being connected to the mid-point tap 3*a* of load resistor 3 in FIGURE I–A.

In FIGURE I–X, I have shown the identical circuitry of

FIGURE I–Y extended to selectively distribute the variable voltage of potentiometer 7 to two or more electrically isolated track sections. The power rail 10*a* of the track 10 is mechanically continuous but electrically separated 19. Is is important that the ground rail 10*b* be both mechanically and electrically continuous.

Each electrically isolated section of the power rail 10*a* is connected to a single pole-single throw-spring disconnect switch 13 which has been wired to distribute the variable voltage output of the variable tap 9 of the potentiometer 7.

In FIGURE II, I show two techniques for actuating accessories requiring "this or that" positioning which can be operated by the power supply configuration of FIGURE I. FIGURE II illustrates both techniques attached to a common power supply, FIGURE II–B, which is identical to the one disclosed in FIGURE I–B.

In FIGURE II–F—B, single throw-single throw-spring disconnect switches 13*a* and 13*b* each distribute one side of the output of the full wave rectifier when connector 6 is mated with the power supply output receptacle 5. In this technique I show two solenoids, one with a clockwise winding 14*a* and the other with a counter clockwise winding 14*b* both aligned along a common axis and arranged to actuate a common core device 15 which, in turn, provides the actuation of the associated accessory. Electrically these two solenoids are joined and the junction 16 is electrically attached to the ground rail 10*b* of the track 10. The opposite end 17*a* of one of the solenoids 14*a* is connected to the discharge side of switch 13*a*. The opposite end 17*b* of the other solenoid 14*b* is connected to the discharge side of switch 13*b*. When switch 13*a* is closed, direct current flows to the solenoid 14*a* moving from point 17*a* to point 16 and thru the ground rail 10*b* of the track 10 back to the power supply. Thus, the actuator core device 15 is moved in one direction until mechanically restrained. Closure of switch 13*b* causes direct current to flow thru solenoid 14*b* from point 16 to point 17*b* causing the actuator to be moved in the opposite direction until again mechanically restrained since, in this case, the windings of this solenoid are reversed.

In FIGURE II–G—B, I show a single solenoid 14 with actuator core 15 within the coil. One end of solenoid 14 is electrically connected to the ground rail 10*b* of the track 10. The other end of the solenoid 14 is connected to the output side of a single pole-double throw switch 18 which is spring loaded to seek a neutral point at rest. In one contact position it attaches electrically to one side of the rectifier output and causes direct current to flow thru switch 18 toward solenoid 14, thru this solenoid to the ground rail 10*b* and back to the power supply.

Placing switch 18 in the opposite position causes direct current to flow from the ground rail 10*b* thru solenoid 14 and toward switch 18 and thence to the power supply. In this manner actuator core 15 is positioned left or right by use of a single solenoid.

While I have described my invention in certain of its preferred embodiments, I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A toy train power supply for a two rail track system utilizing a step down transformer whose secondary voltage is nominally twice the operating voltage of the electric toy, four rectifiers disposed and connected as a conventional full wave rectifier across the output of the secondary coil of the transformer, a high resistance in electrical parallel with a condenser connected across the output of said rectifier circuitry, said high resistance having a center tap which is electrically connected unswitched to one rail of the track, a potentiometer whose resistance is electrically connected across the output of said full wave rectifier, and whose variable tap is connected to the other rail of the track.

2. A toy train power supply for a two rail track system utilizing a step down transformer whose secondary voltage is nominally twice the operating voltage of the electrical toy, four rectifiers disposed and connected as a conventional full wave rectifier across the output of the secondary coil of the transformer, a high resistance in electrical parallel with a condenser connected across the output of said rectifier circuitry, said transformer secondary coil having a mid-point tap connected un-switched to one rail of the track, a potentiometer whose resistance is electrically connected across the output of said full wave rectifier and whose variable tap is connected to the other rail of the track.

3. A toy train power supply for a two rail track system utilizing a step down transformer whose secondary voltage is nominally twice the operating voltage of the electrical toy, four rectifiers disposed and connected as a conventional full wave rectifier across the output of the secondary coil of the transformer, a high resistance in electrical parallel with a condenser connected across the output of said rectifier circuitry, said transformer secondary coil having a mid-point tap connected unswitched to one rail of the track, a potentiometer whose resistance is electrically connected across the output of said full wave rectifier and the output of whose variable tap of the potentiometer is distributed thru "single throw-single pole-single disconnect" electrical switches in parallel each of which is electrically connected to one of the several electrically isolated sections of the other rail of the track.

4. A toy train power supply for a two rail track system utilizing a step down transformer whose secondary voltage is nominally twice the operating voltage of the electrical toy, four rectifiers disposed and connected as a conventional full wave rectifier across the output of the secondary coil of the transformer, a high resistance in electrical parallel with a condenser connected across the output of said rectifier circuitry, said transformer secondary coil having a mid-point tap connected un-switch to one rail of the track, at least two potentiometers each having a separate resistance electrically connected in parallel across the output of said full wave rectifier and the outputs of the separate variable taps of said parallel-connected potentiometers are each distributed thru a separate group of "single throw-single pole-spring disconnect" electrical switches in parallel, one from each group being connected directly, to one of the severally electrically isolated sections of the other rail of the track.

5. In an electrical system for operation of track operated toys, the method of operation comprising:

utilizing the full output of a full wave rectifier connected to the secondary of a step-down transformer to produce a D.C. voltage nominally twice the normal operating voltage required,

distributing the output to electrically parallel potentiometers,

channeling the output of the variable tap of the potentiometers to individual electrically isolated sections of the power rail of the track, each of which is selectively energized by means of separate single throw-single pole-spring release switches,

utilizing additionally the full constant voltage output of the rectifier thru selective switching to energize track accessories, and

grounding all power toy equipment to the only continuous rail of the track which is electrically connected directly to a mid-voltage point of the power supply

whereby the current flow in electrically segmented portions of the power rail of the track system can be individually reversed to change the direction of movement of power operated toys without changing the polarity of the power source.

6. A toy train power supply for a two rail track system utilizing a step down transformer whose secondary voltage is nominally twice the operating voltage of the electrical toy, four rectifiers disposed and connected as a conventional full wave rectifier across the output of the secondary coil of the transformer, a high resistance in electrical parallel with a condenser connected across the output of said rectifier circuitry, said transformer secondary coil having a midpoint tap connected unswitched to one rail of the track, a potentiometer whose resistance is electrically connected across the output of said full wave rectifier used to control the speed and direction of the moving equipment, two solenoids, mechanically arranged in tandem having a common axis and a common actuating core which can be mechanically linked to accessory equipment to provide "this or that" positioning, said two solenoids being electrically connected in series across the output of said full wave rectifier, one being wound in a clockwise direction and the other being wound in a counter clockwise direction, each connection to an output terminal of the full wave rectifier being interruptable by a single pole-single throw-spring disconnect switch, the electrical connection between said two solenoids being also connected to a mid voltage point of the power supply thru the ground rail of the track.

7. A toy train power supply for a two rail track system utilizing a step down transformer whose secondary voltage is nominally twice the operating voltage of the electrical toy, four rectifiers disposed and connected as a conventional full wave rectifier across the output of the secondary coil of the transformer, a high resistance in electrical parallel with a condenser connected across the output of said rectifier circuitry, said transformer secondary coil having a midpoint tap connected unswitched to one rail of the track, a potentiometer whose resistance

is electrically connected across the output of said full wave rectifier used to control the speed and direction of the moving equipment, a single solenoid whose actuating core can be mechanically linked to accessory equipment to provide "this or that" positioning, one side of said solenoid being selectively electrically attached to the two output terminals of said full wave rectifier thru a single pole-double throw-spring disconnect switch, the other end of said solenoid being electrically connected to the mid voltage point of the power supply thru the ground rail of the track.

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