United States Patent

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[54] CONTROL SYSTEM FOR DUAL RAIL MODEL ELECTRIC VEHICLES

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[51] **Int. Cl.** **B60l 15/14**

[58] **Field of Search** 338/68; 104/149, 150, 152; 246/167; 307/43, 12

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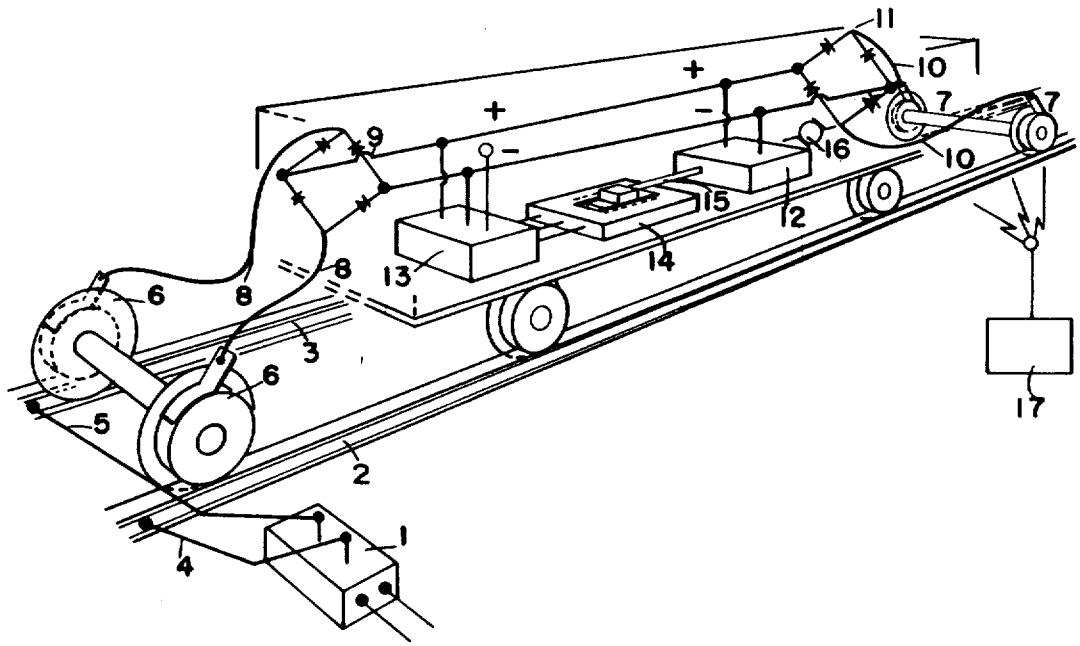
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[57] **ABSTRACT**

A dual rail model electric vehicle control system including a transmitter for sending signals to a receiver mounted on the vehicle. The receiver is connected to a servo motor which, in turn, is connected to a double pole rheostat, whereby the direction and amount of current flowing to the vehicle electric drive motor may be remotely controlled. A double power pick-up is connected to the vehicle wheels which conduct the current from the rails to a double bridge rectifier arrangement, the output of which is connected to the receiver and rheostat.

6 Claims, 5 Drawing Figures



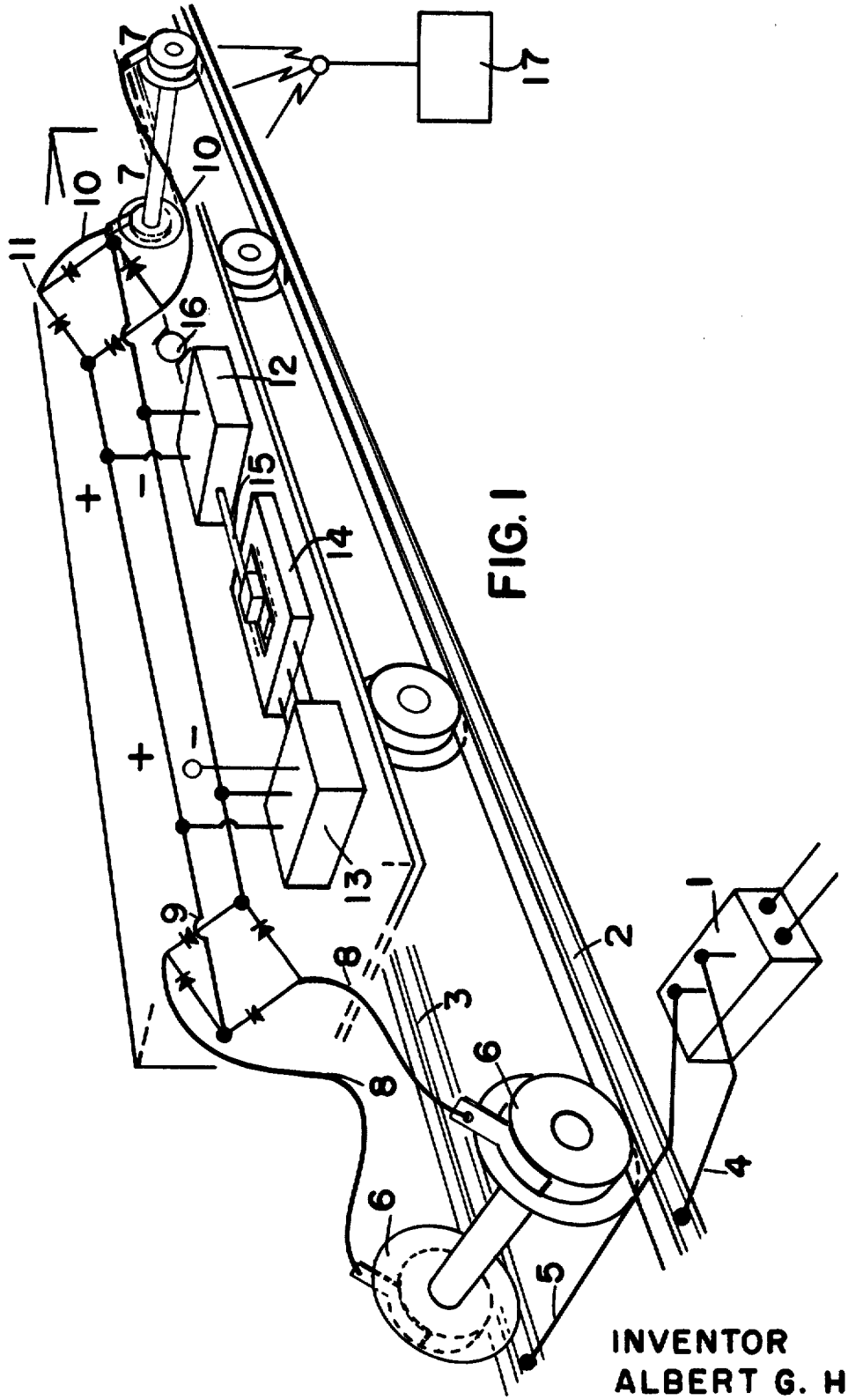


FIG. 1

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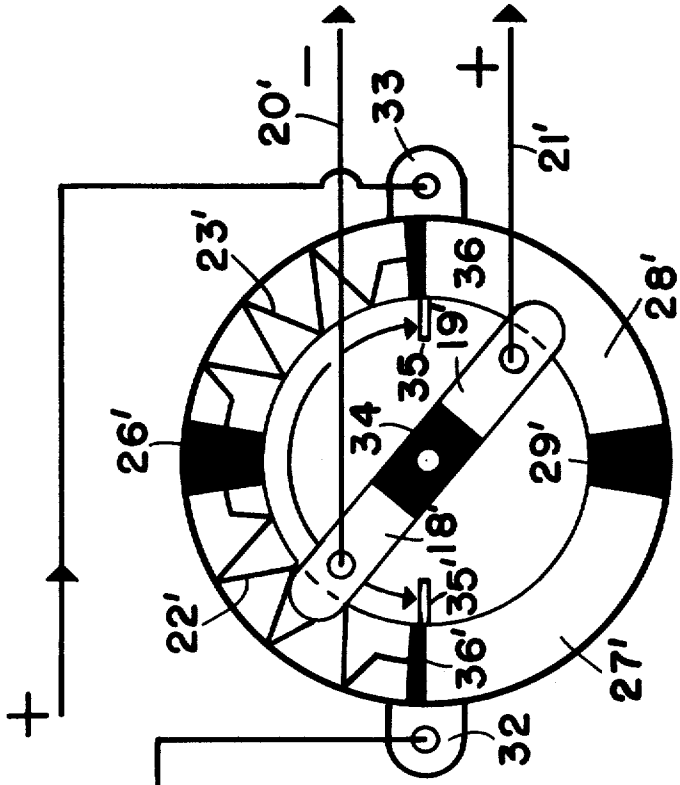


FIG.3

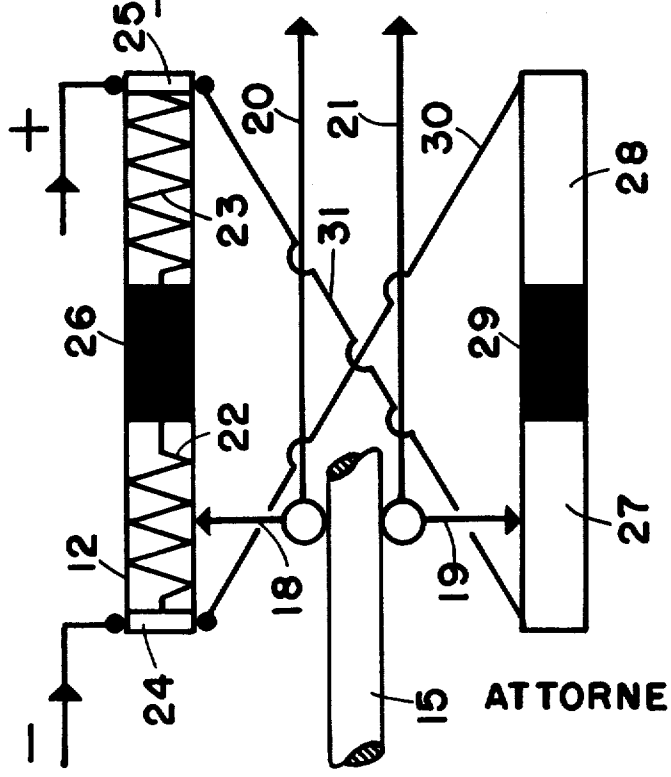


FIG.2

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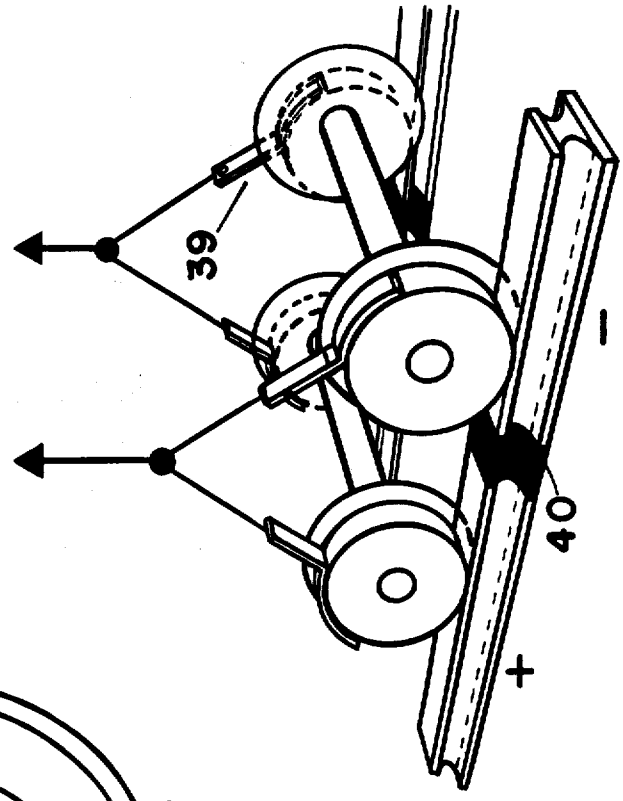


FIG. 5

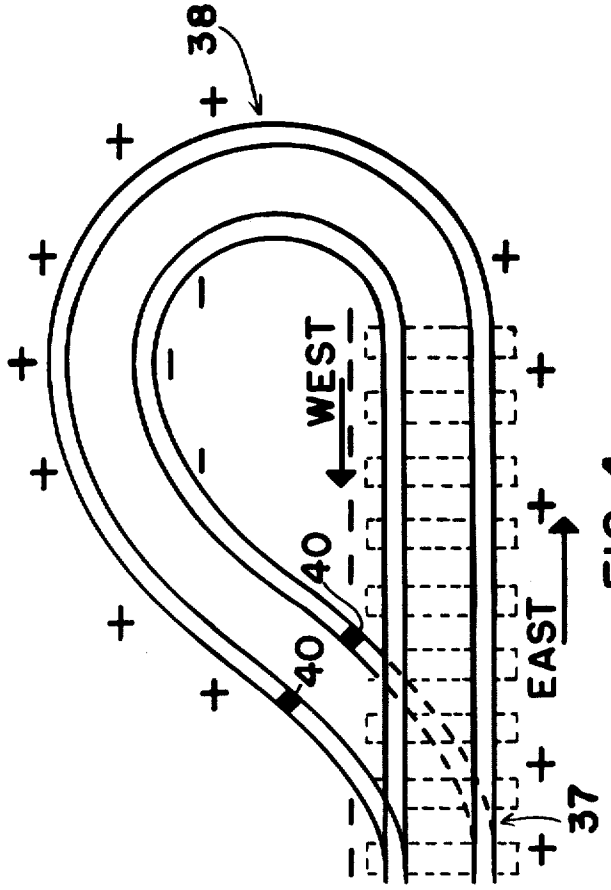


FIG. 4

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CONTROL SYSTEM FOR DUAL RAIL MODEL ELECTRIC VEHICLES

BACKGROUND OF THE INVENTION

It is well known that conventional dual rail model electric vehicles, such as, model electric trains, employing HO gauge track, rely on the polarity of the current conducted by the tracks for controlling the direction of travel of the train, and the amplitude of the current is relied upon for controlling the speed of the train. These systems have many inherent limitations which have restricted the model train hobbyist in devising his track layout. For instance, return, or reverse looping, "wye" turn-arounds, and turntable operations can only be accomplished by employing relatively complex track blocking and track polarity reversing switch systems. Furthermore, independent control of more than one train travelling on the same track requires complicated circuitry, intricate wiring, track section isolation and the like. Also, conventional control devices are physically connected to the track thereby restricting the movement of the hobbyist relative to the layout while manually controlling the train movement. Since most of the train locomotives are driven by D.C. motors, only direct current can be supplied to the track, and lights within the vehicle and other accessories operating off power tapped from the track are operational only when power is being supplied to the track for energizing the train motor.

After considerable research and experimentation, the control system of the present invention has been devised to overcome the above-noted disadvantages experienced in conventional HO gauge train systems, and comprises, essentially, a power pickup connected to one pair of wheels electrically insulated one from the other at one end of the vehicle, and another power pickup connected to another pair of wheels electrically insulated one from the other at the opposite end of the vehicle. Both power pick-ups, however, may be intermediate the ends of the vehicle. Each of the power pick-ups is connected to a respective bridge rectifier, the outputs of which are connected to a receiver and a double pole rheostat mounted on the vehicle. A servo motor is connected between the receiver and the double pole rheostat, and the output of the double pole rheostat is connected to the train electric drive motor. By this construction and arrangement, signals transmitted to the receiver from a transmitter causes the servo motor to be energized, thereby actuating the movable contact of the rheostat whereby the speed and polarity of the train electric motor is controlled.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic, perspective view of the control system of the present invention;

FIG. 2 illustrates the construction of one embodiment of a double pole rheostat employed in the system shown in FIG. 1;

FIG. 3 illustrates another embodiment of the double pole rheostat;

FIG. 4 is a diagrammatic view of a conventional reverse loop employed in a track layout; and

FIG. 5 is a diagrammatic perspective view illustrating the power pickup employed in conventional dual rail systems.

Referring to the drawings, and more particularly to FIG. 1, in conventional D.C. model railroad construction and operation, of which HO gauge is illustrative, D.C. voltage is supplied from a suitable supply source 1 and applied across the rails 2 and 3 through leads 4 and 5, respectively, which provides track power for driving the engine of the train locomotive. The power supplied to the track is picked up by one pair of wheels 6 at one end of the vehicle and by another pair of wheels 7 at the other end of the vehicle. These wheels are of conventional construction and are electrically insulated; each from the other. The power picked up by wheels 6 is conducted through leads 8 to a bridge rectifier 9; power picked up by wheels 7 is similarly conducted through leads 10 to another bridge rectifier 11. The output terminals of one rectifier are connected with the corresponding output terminals of the other rectifier; that is, plus to plus and ground to ground. By this construction and arrangement, regardless of the type of current or the polarity on the section of track upon which the pickup wheels are located, the rectified, polarized current is D.C. and polarized with reference only to the outputs of the bridge rectifiers within the vehicle. It will be appreciated by those skilled in the art that the bridge rectifier arrangement of the present invention thus allows the use of a power source of either A.C. or D.C.

The output of the rectifier circuits is conducted to a double pole rheostat 12, to be described more fully hereinafter, and to a receiver 13 which is electrically connected to a servo motor 14 having a rod 15 connected to the movable contact of the rheostat 12, the output of the rheostat, in turn, being connected to the vehicle electric drive motor 16. The receiver is adapted to receive signals from a suitable transmitter 17 whereby the servo motor and rheostat are actuated. The transmitter, receiver and servo motor are of conventional model airplane radio control unit design, and while the receiver 13, servo motor 14 and rheostat 12 are mounted on the vehicle, the transmitter 17 is adapted to be held by the operator.

The construction of one embodiment of the double pole rheostat 12 is illustrated in FIG. 2 wherein it will be seen that a pair of contacts 18 and 19 are secured to and adapted to be carried by the rod 15. The contacts which are insulated from each other are connected to leads 20 and 21 which, in turn, are connected to the electric drive motor 16. The contact 18 is adapted to engage a pair of resistance windings 22, 23 having their outer ends connected to respective terminals 24 and 25 which are connected to the ground and plus pole, respectively, of the rectified current, the inner ends of the windings being connected to a suitable insulator 26. The contact 19 is similarly adapted to engage a pair of conductor strips 27, 28 having their inner ends connected to an insulator 29. The conductor strip 28 is connected to terminal 24 through lead 30 and the conductor strip 27 is connected to terminal 25 through lead 31.

From the above description, the operation of the double pole rheostat will be readily apparent. Assuming that the direction of current flow, as shown in FIG. 2; that is, lead 20 being of negative polarity and lead 21 being of positive polarity, causes the electric motor to drive the train in a forward direction, then moving the rod 15 and its associated contact 18 to the left increases the power tapped from the rheostat winding 22, thereby increasing the drive motor speed. Conversely, as the contact 18 is moved to the right, the power is decreased thereby decreasing the speed of the drive motor. When the contact reaches insulator 26 there is no flow of current and therefore the drive motor and train are stopped. Further movement of the contact 18 to the right causing it to engage winding 23 results in a reversal of current flow, that is, lead 20 has a positive polarity and lead 21 has a negative polarity. This reversal of current flow causes the electric drive motor to rotate in the opposite direction, thereby causing the train to back up.

The construction and arrangement of the double pole rheostat 12 provides a more realistic simulation of true locomotive action, that is, of slowing down to a stop and then slowly gaining speed when the direction of the train has been reversed, thereby enhancing the credibility of model train operation by eliminating the fast forward motion, abrupt stop, and fast rearward motion displayed by many of today's model railroads.

Another embodiment of the double pole rheostat is illustrated in FIG. 3, wherein it will be seen that the linear configuration of the rheostat shown in FIG. 2 has been modified into an annular configuration; thus, half of the annular configuration consists of the rheostat windings 22' and 23' having their inner ends separated by the insulator 26'; the other half of the annular configuration consisting of the conductor strips 27' and 28' separated at their inner ends by the insulator 29'. The opposite ends of the windings and corresponding ends of the conductor strips are connected to respective terminals 32 and 33 which are connected to the ground and plus pole, respec-

tively, of the rectified current. The movable contacts 18' and 19', separated from each other by an insulator 34, are constructed as a rotary blade adapted to oscillate in the direction of the arrows, shown in FIG. 2, the oscillatory movement of the contacts being limited by suitable stops 35 and 35' electrically isolated from the system by insulators 36.

In the operation of the annular type, double pole rheostat shown in FIG. 3, if the output of the servo motor 14 is reciprocatory a suitable mechanism can be employed to translate this reciprocatory output to oscillatory movement of the contacts 18' and 19'; thus, with the contacts in the position shown in FIG. 3, leads 20' and 21', connected to the train electric drive motor, will be of negative and positive polarity, respectively, thereby causing the electric motor to rotate in one direction. When the contacts are rotated clockwise, so that contact 18' engages winding 23' and contact 19' engages conductor strip 27', the polarity of the leads 20' and 21' are reversed, thus causing the electric motor to rotate in the opposite direction. The manipulation of the annular type rheostat results in a realistic simulation of true locomotive action as described hereinabove with regard to the embodiment of the rheostat shown in FIG. 2, the main advantage of the annular type rheostat shown in FIG. 3 over the linear type rheostat, shown in FIG. 2, being that only one connection need be made at the terminal inputs 32 and 33.

The advantage of the rectifier circuit employed in the control system of the present invention can be fully appreciated by referring to FIG. 4 wherein there is shown a conventional reversing loop. Assuming that a train is travelling east on the main line 37 toward the loop 38, the wheels on the right side of the locomotive will be on the rail of plus polarity. After the locomotive has travelled around the loop and proceeds west on the main line, the wheels on the right side of the locomotive will be on the rail of negative polarity, it will be thus obvious that if the train is to continue forward the polarity of the main line must be reversed. This has been accomplished in conventional model train assemblies by employing relatively complex track blocking and track polarity reversing switch systems; however, the same result has been accomplished by the construction and arrangement of the relatively simple rectifier circuit of the present invention; since, regardless of the polarity of the current in the rail section upon which the pickup wheels are located, the rectified current is polarized with reference only to the outputs of the bridge rectifiers.

The advantage of the dual power pickup of the present invention, in conjunction with the rectifier circuit, can be further appreciated by referring to FIG. 5, wherein a conventional power pickup 39 is illustrated traversing the insulation gap 40, resulting in a short circuiting of the track. A further benefit of the instant dual pickup, double bridge rectified arrangement being that power to the vehicle can still be admitted even though one pickup wheel pair may be on "dead" track such as an insulated frog in a section of switch track. One arrangement of the dual power pickup is illustrated in FIG. 1 wherein the receiver 13, servo motor 14 and rheostat 12 would be contained within one of the cars of a train, and the pickup leads 7 and 8 would be connected to respective pairs of wheels at points intermediate the ends of one of the cars of the train, or, if desired, at points intermediate the ends of the train.

Yet still another advantage of the control system of the present invention is the use of the transmitter 17 for the remote control of the double pole rheostat 12, whereby the hobbyist may change his position with respect to the track layout when desired, and by employing a transmitter with a multiple transmission frequency capability, a plurality of trains on the same track may be independently controlled, provided each train has a receiver with a given frequency.

While the control system of the present invention has been described for use with HO gauge model train layouts, it will be appreciated by those skilled in the art that the system can be readily adapted for use with other types of model electric vehicles, such as, racing cars.

I claim:

1. A power supply and control system for electric model vehicles of the type having electrical power delivered to a track and conducted through the vehicle wheels on the track to an electric drive motor mounted on the vehicle, the improvement comprising, multiple power pick-up means intermediate the ends of said vehicle, rectifier circuits mounted intermediate the ends of said vehicle, each pick-up means being connected to a respective rectifier circuit, the output of each rectifier circuit being connected with the corresponding polarity of the output of the other rectifier circuits, receiver means and rheostat means mounted on said vehicle, the output of said rectifier circuits being connected to said receiver means and said rheostat means, servo motor means mounted on said vehicle, said servo motor means being operatively connected to the receiver means and said rheostat means, and transmitter means adapted to transmit signals to said receiver means, whereby the servo motor means is energized to thereby actuate the rheostat means to control the polarity and amount of current conducted to the electric drive motor of the vehicle.

2. A power supply and control system for electric model vehicles, according to claim 1, wherein the power pick-up means comprises multiple pairs of wheels intermediate the ends of said vehicle, and one end of a lead connected to a respective wheel of each pair of wheels, the opposite end of each lead being connected to a respective rectifier circuit.

3. A power supply and control system for electric model vehicles, according to claim 1, wherein the rheostat means comprises a pair of longitudinally spaced resistance windings, the inner ends of said resistance windings being connected to an insulator, the outer end of one of said windings being connected to the negative output of the rectifier circuit, the outer end of the other winding being connected to the positive output of the rectifier circuit, a pair of longitudinally spaced conductor strips disposed parallel to and spaced from the pair of resistance windings, the inner ends of said conductor strips being connected to an insulator, one conductor strip being electrically connected to the outer end of one of the windings, and the other conductor strip being connected to the outer end of the other winding, a pair of movable contacts disposed between said windings, one of the contacts adapted to engage the windings and the other contact adapted to engage the conductor strips, electric drive motor leads connected to said contacts, and an actuating rod connected to said contacts, said actuating rod being connected to the servo motor means.

4. A power supply and control system for electric model vehicles, according to claim 1, wherein the rheostat means comprises, an annular member including a pair of circumferentially spaced resistance windings, the adjacent ends of the windings being connected to an insulator, a terminal being connected to each of the opposite ends of the windings, each terminal being connected to a respective polarity output of the rectifier circuit, a pair of arcuate, circumferentially spaced, conductor strips, the adjacent ends of said conductor strips being connected to an insulator, the opposite ends of said conductor strips being connected to said terminals, a rotary member mounted concentrically within said annular member, a contact mounted on one end of said rotary member adapted to engage said winding, another contact mounted on the other end of said member adapted to engage said conductor strips, electric drive motor leads connected to said contacts, and the servo motor means being operatively connected to said rotary member.

5. A power supply and control system for electric model trains of the type having electrical power delivered to the rails of a track and conducted through the vehicle wheels on the rails to an electric drive motor in the train locomotive, the improvement comprising, a plurality of power pick-up means at longitudinally spaced locations on said train, rectifier circuits mounted intermediate the ends of a car in said train, each pick-up means being connected to a respective rectifier circuit, the output of each rectifier circuit being connected with the corresponding polarity of the output of the other rectifier circuits, receiver means and rheostat means mounted in said

car, the output of said rectifier circuits being connected to said receiver means and said rheostat means, servo motor means mounted in said car, said servo motor means being operatively connected to the receiver means and said rheostat means, and transmitter means adapted to transmit signals to said receiver means, whereby the servo motor means is energized to thereby actuate the rheostat means to control the polarity and amount of current conducted to the electric drive motor in the locomotive.

6. A power supply and control system for electric model trains, according to claim 5, wherein the power pick-up means comprises a pair of wheels on a car in the forward portion of the train and a second pair of wheels on another car in the rear portion of the train, and one end of a lead connected to a respective wheel of each pair of wheels, the opposite end of each lead being connected to a respective bridge rectifier circuit located in a car intermediate the end portions of the train.

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