MODEL RAILROAD SYSTEM

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ABSTRACT

A model railroad system comprises a main track; a charging station; and a locomotive having an electric motor and wheels moveable along the track. A rechargeable source of electrical power is moveable with the locomotive and electrically conductive contacts on the locomotive or on a car connected to the locomotive engage electrically conductive recharging contacts at the charging station. A wirelessly controllable motor control circuit moveable with the locomotive supplies electrical power from the rechargeable source to the motor and controls the speed and direction of movement of the locomotive along said track.
FIG. 5

FIG. 6
MODEL RAILROAD SYSTEM
CROSS REFERENCE TO RELATED APPLICATIONS, IF ANY

BACKGROUND OF THE INVENTION AND PRIOR ART

The present invention relates generally to model railroads and more particularly to model railroads of the type in which electrical power is ordinarily supplied from electrically conductive tracks to a locomotive. Typically, an electric motor on the locomotive transmits power to the drive wheels through a drive shaft and gear set generally mounted on or near its axles. These locomotives generally rely for power on a variable direct voltage of up to 12 volts on a two-rail system or, with a three-rail system, a variable alternating voltage of up to 18 volts. Power is supplied to the track by an electrical transformer connected to a wall outlet. The transformer includes controls to enable the operator to propel the locomotive and train at a selected speed and direction. The locomotive relies for power on the current conducted through the rails to the motor and thence to the axles and wheels. The efficiency of conduction of electric current to the motor is significantly affected by the quality of the contact between the wheels and rails. Dirt, oil and other contaminants readily adhere to the rails due to static electricity and significantly interfere with smooth operation of fine-scale model railroads, requiring the operators to spend a great deal of time and effort in cleaning the rails and wheels. Many model railroad enthusiasts purchase elaborate rail cleaning devices, such as model railroad cars with either chemical or mechanical cleaning systems, and use electrically-conductive metal brushes to clean locomotive wheels.

OBJECT OF THE INVENTION

The primary object of the present invention is to provide a model railroad locomotive that avoids or at least reduces the time required for cleaning of the rails and wheels.

SUMMARY

Disclosed herein is a model railroad system which includes a main track and a recharging station. A locomotive having an electric motor and wheels moves along the track and a rechargeable source of electrical power is moveable with the locomotive. The locomotive carries electrically conductive contacts which engage electrically conductive recharging contacts at the charging station. A wirelessly controllable electrical signal receiver and control circuit which is moveable with the locomotive is provided for supplying electrical power from the rechargeable source to the motor and controlling the speed and direction of movement of the locomotive along the track.

The source of rechargeable power may comprise an array of rechargeable batteries carried in the locomotive itself or on another car, for example, in the case of model steam locomotives, in the locomotive tender, whereby completely avoiding any reliance on the tracks for electrical current. Remotely controlled model railroad locomotives can be operated on conventional model railroad layouts without interfering with present methods of operating model trains, thereby permitting a gradual transition from conventional power supplies to battery power without incurring large conversion expense.

Locomotives embodying the invention can be operated on return loops and other turning tracks without regard to electrical polarity.

A convenient means by which the radio crystals can be easily changed in the locomotive will be disclosed, allowing the simultaneous operation of several locomotives independently or of multiple locomotives together, much as they are operated in full-size railroad operations and without exceeding the capacity of the transformer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a model railroad system.

FIG. 2 is an exploded perspective view of a model diesel locomotive having a chassis and removable cover for housing an electric motor and a rechargeable source of electrical power.

FIG. 3 is a schematic view showing depicting wireless remote control of the locomotive of FIG. 2.

FIG. 3A is an enlarged portion of FIG. 3.

FIG. 4 is a schematic perspective view of a differently configured locomotive parked at a recharging station.

FIG. 5 is a schematic diagram of a battery charging circuit.

FIG. 6 is a block diagram of a motor control circuit including a receiver of wireless signals for remotely controlling the locomotive.

FIG. 7 is a schematic of the presently preferred embodiment of the motor control circuit shown in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 schematically shows a model railroad system having a main track 10, a first charging station 20 and a second charging station 30 which comprises an electrically energizable section of track separate from the main track and a charger 32 connectable by an electric cord 34 to a conventional wall outlet. Although the main track 10 is shown in the form of a loop for simplicity, the configuration of the main track 10 can take any desired form as desired by the model railroad enthusiast. Similarly, the second charging station 30, shown in solid lines as a dead end section of track on which the locomotive can be parked for charging a rechargeable source of electrical power 80 mounted on the locomotive or on a separate car moveable with the locomotive, may also comprise a loop as shown in broken lines or any other desired configuration. Optionally, a transformer 40 which may be connected via an electrical cord 42 to a wall outlet is shown for electrically energizing the main track 10 when desired. The first charging station 20 is also connectable via an electrical cord 22 to a wall outlet. A hand held transmitter 50 is depicted for wireless transmitting control signals to a motor control circuit which can be located anywhere on the train 60, but preferably is located on the locomotive 62 or on a car 64 adjacent the locomotive for
moving the train 60 at the desired speed and direction via a motor 70 on the locomotive. The motor 70 may be powered by a rechargeable source 80 of electrical power or, in a preferred embodiment, also by electrical power drawn through electrically conductive wheels 90 engaged with electrically conductive tracks having spaced rails 12, 14 to which power is supplied by the transformer 40.

[0017] FIG. 2 depicts a locomotive 60, in this case a diesel locomotive, having a chassis 66 supported on a plurality of trucks 68 and wheels 90. A DC drive motor 70 and gear train for driving the wheels and a rechargeable source 80, preferably at least one or more rechargeable batteries, is supported on the chassis 66 along with an electrical motor control circuit 100 which includes an antenna 102 for receiving wirelessly transmitted motor control signals. The motor 70 and gear train drive one or more of flanged wheels 90 gauged to run on rails 12, 14. A locomotive body or cover 69, depicted in FIG. 2 as a diesel engine, encloses the motor 70, the rechargeable source of electrical power 80 and the motor control circuit 100 as shown. The antenna 102, in the diesel engine embodiment shown, preferably comprises the metal handrail of the locomotive so as to camouflage the antenna. The locomotive 60, however depicted, ideally accurately replicates a full-size locomotive style, but in the same scale as the chassis, i.e., HO scale (1:87), S scale (1:64), 0 scale (1:48), or G scale (1:24). The rechargeable source of electrical power 80 may comprise batteries capable of producing from 6-12 volts such as lithium ion batteries. Three 3.7V batteries connected in series with one 3.7V battery connected in parallel have been found to be satisfactory.

[0018] FIGS. 3 and 3A schematically depict remote control of the locomotive 60. A manually operable switch 104 is preferably provided on the chassis 66 externally of the locomotive cover 69 for setting the motor control circuit 100 to Run, Off and Recharge positions. FIG. 4 depicts a locomotive 60, depicted as a steam locomotive, docked at the first charging station 20, which is depicted as a house. Mating spaced electrically conductive contacts 110, 112, 120, 122 on the locomotive 60 and first charging station 20 come into engagement when the locomotive is parked at the charging station for transmitting charging power to the rechargeable source of power 80 on the locomotive.

[0019] In FIG. 5, the charging station, which may comprise the first and/or second charging station 20, 30 shown in FIG. 1 provides a source of power, typically 12 V DC, which is supplied on lead 130 to the rechargeable source of power 80 and charging circuit in block 140 and on lead 132 through a safety circuit 150 to the motor control circuit 100.

[0020] If the train is electrically connected by the contacts 110, 112; 120, 122 to the first charging station 20 or by electrically conductive wheels and tracks at the second charging station 30, 12 V is present at the (white) lead W of the charging circuit in block 140 therefore charging the rechargeable source 80. Also, 12 V is present from line 132 at the collector and base of transistor Q1 to saturate transistor Q1 allowing current to flow from the emitter to the positive terminal + of the motor control circuit 100. This allows the rechargeable source 80 to be charged on line 134 and at the same time the train can be operated if desired. Meanwhile, 12V is also present at the negative terminal – of a comparator 160. Since this 12 V is higher than the 3V present at the positive terminal + of the comparator 160, the output of the comparator will be low, which turns OFF transistor Q2. Therefore no current will be drained from the rechargeable source 80 on lead 134.

[0021] When the train is not connected to the first or to the second charging station 20, 30, 0 V will be present at the collector and base of transistor Q1, therefore transistor Q1 will be OFF. 0 V will also be present at the negative terminal – of the comparator 160. The output of the comparator 160 in this case will be high and will turn transistor Q2 ON. When Q2 is ON, current is drawn from the (red) line R on line 134 of block 140, and current flows out of the emitter of transistor Q2 on line 136 to the motor control circuit 100. In this case the rechargeable power source 80 supplies power to the motor 70.

[0022] FIG. 6 is a block diagram depicting the presently preferred embodiment of train control circuit shown in greater detail in FIG. 7. A modulated RF train control signal is received, amplified and prepared for demodulation in unit 170 which includes the antenna 102, a filter and an amplifier. A local oscillator 180 generates a sinusoidal carrier signal at a frequency required for demodulation. Preferably a common-emitter Colpitts oscillator is used for this purpose. A mixer 190 preferably attenuates and mixes the RF control signal with the carrier signal produced by the local oscillator 180. The mixed control and carrier signal is supplied to frequency demodulator 200 which converts the desired frequency representation of train speed to a DC voltage representation of the desired speed. A pulse width modulator 210 and power buffer 220 then converts the voltage representation of desired speed into a square wave signal where speed is represented as a function of pulse width which is used to control the speed of the locomotive motor 70.

[0023] The presently preferred power buffer 220 shown in FIG. 7 comprises an H-bridge power buffer for the pulse width modulation circuit, allowing the motor to be controlled by the pulse width modulation signal. Optionally, auxiliary detectors 230 using tank circuits may be provided to detect the presence of horn, light or reverse signals with an output circuit 240 for implementing the action of a headlight and horn.

Operation

[0024] In operation, the locomotive 60 is positioned on the rails and coupled to one or more model freight or passenger cars. Should the user wish to control more than one locomotive, local oscillators 180 with replaceable crystals producing different carrier frequencies may be inserted each having a frequency that matches the frequency of the transmitter 50. Switch 104 is then moved to the “Run” position. Once this step is completed, the user is able to cause electric current to flow from the rechargeable source 80 to the motor 70, at variable speeds and in either direction on the railroad by means of the hand-held transmitter 50. The transmitter 50 broadcasts a signal to the crystal of the local oscillator 180 to allow the electrical current to pass from the rechargeable source 80 to the motor 70. The signal is received by the antenna 102, which may comprise the locomotive handrail, and is connected to the crystal. The signal is variable to allow the user to determine the amount of current (speed) and polarity of the current (direction) that is conducted to the motor 70. When the rechargeable power source 80 is depleted or the user decides to terminate the
operation, the user parks the locomotive at the first or the second recharging station 20, 30 (the recharging station 30 comprises a section of track that is electrically isolated from main track 10), and moves the switch 104 to the “Recharge” position. The charger 32, which is connected to that section of track, is then turned on, allowing the rechargeable source 80 to be recharged with current that is conducted to it through the electrically conductive rails and locomotive wheels.

[0025] A model railroad system has been described in which a train can be remotely controlled by wireless signals and operated from battery power alone while remotely controlled therefore allowing the operator to electrically disconnect the main track 10 to avoid buildup and repeated cleaning of dirt, oil, grease and debris which adversely affect the electrical contact of conductive wheels and rails and operation of rail powered model trains. Trains of the types disclosed herein can be operated without interfering with present methods of operating model trains and on the same tracks at the same time if desired, one train being operated remotely by wireless control of current derived from a rechargeable on-board source 80 of electric power and the other train operated conventionally by drawing power from electrically charged rails through conductive wheels. The power source 80 can be recharged from either a first charging station 20 at which the locomotive may be docked or from a second charging station 30 comprised of a section of track. Either or both types of charging stations may be provided in the same system and alternately used as desired. The model railroad system disclosed herein permits an operator to gradually transition from conventional power supplies to on board power without incurring significant conversion expense and, unlike conventional systems, allows locomotives to be operated in return loops and other turning tracks without regard to electrical polarity. The on board power source 80 can be recharged from an electrically conductive track and wheels while the train is moving on the track under power supplied by the rechargeable source 80.

[0026] Persons skilled in the art will readily appreciate that various modifications can be made from the presently preferred embodiments disclosed and that the scope of protection is defined only by the limitations of the appended claims.

1. A model railroad system comprising a main track; a charging station; and a locomotive having an electric motor and wheels moveable along said track, a rechargeable source of electrical power moveable with said locomotive, electrically conductive contacts engageable with electrically conductive recharging contacts at said charging station and a wirelessly controllable motor control circuit moveable with said locomotive for supplying electrical power from said rechargeable source to said motor and controlling the speed and direction of movement of said locomotive along said track.

2. The system of claim 1, wherein at least two of said wheels are electrically conductive and said charging station comprises an electrically energizable section of track separate from said main track whereby said locomotive may be parked on said electrically energizable section of track for supplying recharging power through said electrically conductive wheels to said rechargeable source.

3. The system of claim 1, wherein said locomotive includes spaced electrically conductive recharging contacts and said charging station includes spaced electrically conductive contacts respectively engageable with said recharging contacts on said locomotive when said locomotive is parked at said charging station.

4. The system of claim 1, wherein said rechargeable source comprises lithium ion batteries.

5. The system of claim 4, having three of said batteries connected in series and one of said batteries connected in parallel.

6. The system of claim 5, wherein at least some of said batteries are mounted on said locomotive.

7. The system of claim 5, wherein at least some of said batteries are mounted on a railroad car in a train connected to said locomotive.

8. A model railroad locomotive having an electric motor, wheels engageable with a track, a rechargeable source of electrical power moveable with said locomotive along said track for energizing said motor and a wirelessly controllable motor control circuit moveable with said locomotive for supplying electrical power from said rechargeable source to said motor and controlling the speed and direction of said locomotive.

9. The locomotive of claim 8, wherein said rechargeable source of electrical power and said motor control circuit are mounted on said locomotive.

10. The locomotive of claim 8, wherein said rechargeable source of electrical power and said motor control circuit are mounted on a railroad car in a train connected to said locomotive.

11. The locomotive of claim 8, wherein at least some of said wheels are electrically conductive and capable of supplying electrical power from electrically conductive tracks to said motor and said circuit includes a switch for electrically connecting said conductive wheels or said rechargeable source of electrical power to supply electrical power to said motor.

12. The locomotive of claim 11, wherein said electrical switch is manually operable.

13. The locomotive of claim 11, wherein said electrical switch is wirelessly operable.

14. The locomotive of claim 13, wherein said rechargeable source comprises lithium ion batteries.

15. The locomotive of claim 14, having three of said batteries connected in series and one of said batteries connected in parallel.

16. The locomotive of claim 15, wherein at least some of said batteries are mounted on said locomotive.

17. The locomotive of claim 15, wherein at least some of said batteries are mounted on a railroad car in a train connected to said locomotive.

18. A model railroad car having wheels engageable with a track and a rechargeable source of electrical power mounted on said railroad car, said car including an electrically conductive coupler for electrically connecting said car to a mating electrically conductive coupler of a locomotive having an electric motor and wheels engageable with said track, and a wirelessly controllable motor control circuit on said car for supplying electrical power from said rechargeable source to said electrically conductive coupler for energizing said motor on said locomotive.

19. The railroad car of claim 18, wherein at least some of said wheels are electrically conductive and capable of supplying electrical power from electrically conductive tracks to said rechargeable source and said circuit includes a switch
for electrically connecting said conductive wheels to said rechargeable source of electrical power to supply recharging power to said rechargeable source.

20. The railroad car of claim 19, wherein said electrical switch is manually operable.

21. The railroad car of claim 19, wherein said electrical switch is wirelessly operable.

22. The railroad car of claim 21, further comprising an antenna on said car for receiving wirelessly transmitted signals for controlling said electrical switch.

23. The railroad car of claim 22, wherein said antenna comprises a handrail on said railroad car.

24. The railroad car of claim 18, wherein said locomotive is constructed to HO model railroad gauge scale and said rechargeable source of electrical power comprises batteries capable of producing in the range of 6-12 v.

25. The railroad car of claim 24, wherein said batteries comprise lithium ion batteries.

26. The railroad car of claim 25, having three of said batteries connected in series and one of said batteries connected in parallel.

27. A model railroad kit comprising: a main section of track; a locomotive according to claim 8 moveable along said track; a charging station comprising a section of electrically conductive track on which said locomotive can be parked during recharging of said rechargeable source of electrical power; and a source of electrical power for energizing said conductive track to recharge said rechargeable source of electrical power.

28. The kit of claim 27, further comprising an electrical switch on said locomotive for electrically connecting electrically conductive wheels on said locomotive to said rechargeable source of electrical power.

29. The kit of claim 28, further comprising a wireless transmitter for producing control signals to selectively position said switch to supply power to said motor from said rechargeable source or to recharge said rechargeable source from said track section.

30. A model railroad kit comprising: a main section of track; a locomotive according to claim 8 and a charging station adjacent to which said locomotive can be parked during recharging of said rechargeable source of electrical power, said locomotive and said recharging station having mating electrical contacts for transmitting electrical power from said recharging station to said rechargeable source of electrical power.

31. The kit of claim 30, wherein said main track section is electrically conductive and said locomotive has at least two electrically conductive wheels for drawing power from said main track section and further comprising: a transformer for electrically energizing said main track section; an electrical switch on said locomotive for electrically connecting either said electrically conductive wheels or said rechargeable source of electrical power to supply electrical power to said motor.

32. The kit of claim 31, further comprising a transmitter of wireless control signals for supplying locomotive power to said motor from said rechargeable source.

33. The kit of claim 32, wherein said control signals further control recharging of said rechargeable source from said charging station when said mating electrical contacts are engaged.

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