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MODEL RAILROAD CONTROL SYSTEM

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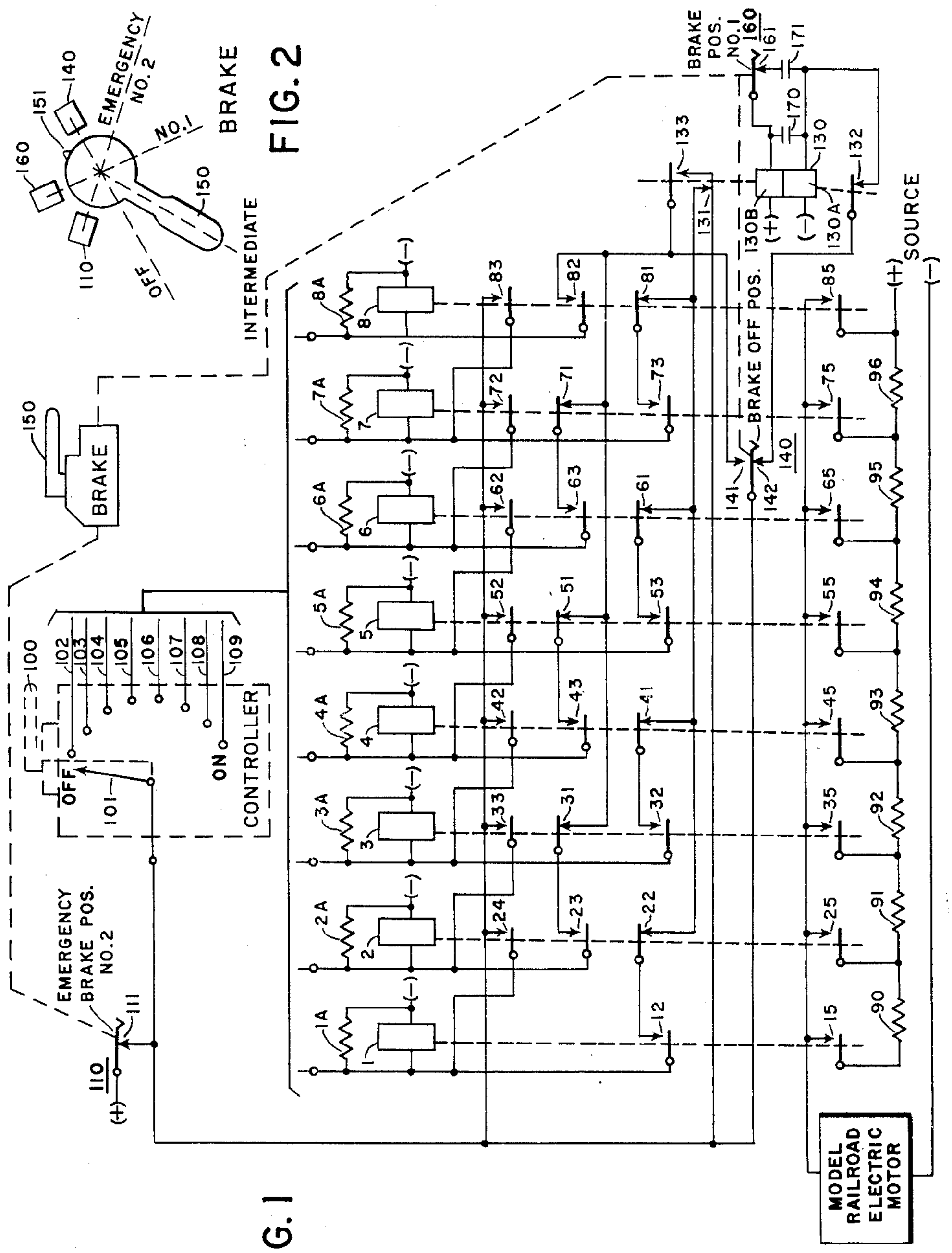

FIG. 2

FIG. 1

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MODEL RAILROAD CONTROL SYSTEM

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The present invention relates to an electrical control system and, more particularly, to a control system for an electrically operated model railroad.

Electrically operated model railroads of either the toy train or the scale model types are popular indoor hobby diversions for both young and old. Toy train systems are usually electrically operated by alternating current supplied by a variable voltage step-down transformer. On the other hand, scale model railroads are usually electrically operated by direct current supplied from a step-down transformer and dry rectifier power supply. With both systems, the trains are entirely controlled by either a transformer control lever or a rheostat to vary the applied voltage and hence the speed of the train. Model trains, due to the types of drive gearing used, do not coast to any extent after the driving current is disconnected. Also, prior to this invention, the functions of both accelerating and braking of the toy or model trains are all controlled by operating the single speed control lever or knob controlling the amount of the applied power. Therefore, without coasting provisions and without separate braking, a good simulation of throttle and brake operation is not obtained with the prior art control systems.

It is an object of this invention to provide a new and improved control system for controlling the application of power to electric motors or the like such that the application of power is controlled by a particuar operation of a control member while the maximum rate of reduction of the power is predetermined and not controlled by any operation of the aforesaid control member.

It is also an object of the present invention to provide an improved model electric railroad control system which will enable a continued powered movement of the train and therefore a simulated coasting of the electric train after the speed controller controlling the supply of power to the track and train is returned to the starting position.

An important object of the invention is to provide an improved control arrangement for electrically powered model railroad systems having both speed and braking controls remote from the train and track and arranged to simulate the operation of prototype trains by the model trains in their use.

Another important object of the invention is to provide an improved control system for an electrically operated model railroad which will enable a simulated coasting after the remote speed controller is returned to or towards the starting position and which will also provide a separate remotely positioned simulated brake control for controllably stopping the model train to simulate prototype train brake operation.

Yet another object of the invention is to provide an improved remote control arrangement for electrically powered model trains which will provide a gradually decreasing amount of applied power to the track and train after the speed controller has been returned towards the minimum power or zero speed position to thus enable the model train to gradually reduce speed and thereby

simulate a coasting function even though friction would normally tend to immediately stop the model train without coasting if power were not applied.

A feature of the invention is the provision of a remotely positioned speed controlling throttle lever or first control member and a brake lever or second control member, together with a train control circuit connected to the track and train to be controllably energized in accordance with various positions of the throttle and brake levers or control members. The applied power for the model train electric motor is supplied through the control circuit in a variable amount which is controlled by the relative positions of the throttle and brake lever control members. The throttle lever may have a minimum power or zero speed position and a plurality of successive positions to control the power supply circuit to supply correspondingly increasing amounts of power to the model train system. The control circuit further includes holding means to continue to supply the power to the system after the throttle lever has been returned to a lower speed setting or the zero speed position. The control system holding means may be further modified to automatically and gradually reduce the applied power to the minimum power established by the subsequent lower position of the throttle, thus providing a decreasing coasting speed for the model train to simulate prototype train coasting.

Having provided remote controlled power holding and modifying means as described above, the invention further features another modification of the circuit holding means to provide a rapid reduction of applied power to the track and train by the control system when the remotely positioned brake handle associated with the control system is moved to a predetermined brake position and also provides for an immediate disconnection of applied power to the track and train when the brake handle is moved to another predetermined position which may be termed an emergency brake position.

In the foregoing paragraphs, reference has been made to track and train and it should be understood that in actuality, the control system of the invention is adapted to control the application of power to an electric motor embodied in the train that runs on the track and collects its power from the track through conventional current pickup devices.

Further objects, features, and the attending advantages of the invention will be apparent with reference to the following specification and drawing in which

Fig. 1 is a schematic wiring diagram, and

Fig. 2 is a diagrammatic showing of one arrangement for the brake handle operated switches.

Referring to the drawing, it should be understood that the control system of the invention may be used for either alternating current or direct current operated model railroad systems, it being only necessary to use either A.-C. or D.-C. operated relays, accordingly. For purposes of the present description, the remote control system is used with a source of direct current, indicated by the plus and minus sign, respectively, and this source of direct current may be used to power both the control system relays and the model railroad track and train.

The control system is provided with a plurality of control relays **1–8**, respectively, one each for each step of speed control desired. When each respective relay is operated, a desired amount of resistance in series with the power source and the model railroad track and train is short circuited. It should be pointed out that alternatively the control relays **1–8** may control the connection of respective transformer taps to the track and train circuit instead of the resistance units shown. Thus, with all relays operated, the power source is connected to the model railroad track and train with maximum power affording a maximum speed of operation. As specifically shown, normally opened contacts **15** of relay **1**, **25** of relay **2**, **35** of relay **3**, **45** of relay **4**, **55** of relay **5**, **65** of relay **6**, **75** of relay **7**, and **85** of relay **8** are arranged to be closed when the respective relay is operated and the closing of these contacts effects a corresponding reduction in the total series resistance provided by the series resistor sections **90–96**.

To control the energization and operation of relays **1–8**, a remotely positioned simulated throttle or electric controller member **100** is provided. The controller member **100** is connected to move the switch arm **101** into progressive contact with switch contacts **102–109** as the controller handle **100** is moved from the minimum throttle position to the maximum full throttle position. A positive terminal of the power supply source is connected through normally closed switch contacts **111** associated with the remotely positioned brake lever and to be later referred to in greater detail, to the switch arm **101** of the speed controller. When the controller member or handle **100** is advanced to the position where switch arm **101** engages contact **102**, a circuit is completed to operate relay **1** from the negative terminal of the power source through the coil of relay **1**, switch contact **102**, switch arm **101**, and normally closed switch contacts **111** to the positive terminal of the power source. Relay **1**, in operating, closes its normally opened contacts **12** to establish a locking circuit for relay **1** which may be traced from the negative terminal through relay coil **1**, operated contacts **12**, normally closed contacts **22**, and normally closed interrupter contacts **131** to the normally closed switch contacts **111** and the positive terminal of the power source. Thus, it will be seen that the controller **100** may then be returned to the zero position after relay **1** has been operated and relay **1** will remain operated even though the controller is returned to the starting position so long as the interrupter contacts **131** remain in their normally closed position.

When the controller handle **100** is advanced to the second step position so that the switch arm **101** establishes contact with switch contact **103**, both relays **1** and **2** become operated. Relay **2** is initially operated over the path traced from the positive terminal of the power supply, normally closed switch contacts **111**, switch arm **101**, controller switch contact **103**, and coil of relay **2** to the negative terminal of the power supply. Relay **2**, in operating, closes normally opened contacts **23** which establishes a locking path for relay **2** through normally closed contacts **31** and operated contacts **141** of the brake off position switch **140** (Fig. 2), assuming that the brake handle or control member **150** is in the brake off position so that switch **140** is operated. Relay **2**, in operating, also provides an alternate operating circuit for relay **1** from the negative terminal of the power source through the coil of relay **1**, operated contacts **24**, and normally closed switch contacts **111** to the positive terminal of the power supply. Thereafter, the control handle **100** may be returned to the starting position and relays **1** and **2** will remain operated through the locking circuits traced above to thereby supply power through resistors **91–96** to operate the model train at comparatively slow speed.

When the controller **100** is operated to advance the switch arm **101** to contact **103**, relay **3** will become operated through a similar operating path to that of relay **1** establishing a locking circuit for relay **3** through operated contacts **32** and normally closed contacts **41** to the normally closed interrupter contacts **131**. The operation of relay **3** also closes contacts **33** to provide an alternate operating and locking path for relay **2**. Similarly, when relay **4** is operated by advancing the control lever **100**, contacts **42** are closed to provide an operating and locking path for relay **3** and contacts **43** are closed to provide a locking path for relay **4** as established through normally closed contacts **51** of relay **5** and operated contacts **141** of the brake off position switch. Similarly, relay **5** is operated when the control handel is moved to establish contact with switch contact **106** and operated relay **5** closes contacts **52** to provide an operating and locking circuit for relay **4** and also closes contacts **53** to provide a locking circuit for itself through normally closed contacts **61** and normally closed contacts **131** of the interrupter.

The operationo f the remaining control relays **6**, **7** and **8** is the same as previously described for control relays **1–5** and the initial locking circuits for relays **6** and **8** are established through the normally closed interrupter contacts **131** while the initial locking circuit for relay **7** is established through the operated contacts **141** of the brake off position switch.

Considering the operation of the circuit as thus far described, it will be seen that upon advancing the control handle **100** progressively from contact position **102** to contact position **109**, relays **1–8** will become operated in turn. It will also be noted that the operation of relay **2** provides an operating and locking circuit for relay **1**, the operation of relay **3** provides an operating and locking circuit for relay **2**, and so forth, until relay **8** is operated, which provides an operating and locking circuit for relay **7**. Also, it is assumed that the brake handle is in the off position so that switch **140** is operated by cam **151** and normally opened contacts **141** are closed and contacts **142** are open so that the interrupter relay **130** is not operating. Therefore, normally closed contacts **131** are also closed so that the locking circuit paths for relays **1–8** are complete through the normally closed emergency brake position switch **110**. Therefore, the controller **100** may be returned towards the zero or starting position and relays **1–8** will remain operated. The relay chain is such that should the controller handle be advanced only to the intermediate position for successively closing contacts **102–106**, then only relay **1–5** would be operated and would remain operated after the controller handle is returned towards the starting position. In other words, each of the relays **1–8** will become operated depending upon the maximum position to which the control handle is advanced and will remain operated after the handle is returned to any lower position than the starting position. This has the effect of providing continuous speed coasting for the model railroad train since the power is initially applied by advancing the control handle and remains on after the control handle has been returned to the starting position simulating a power off condition for the control handle while actually supplying power to the model railroad through the operated contacts of the the controller relays **1–8** that may be operated and locked.

When it is desired to stop the train, however, considering the operation of the control system as thus far described, it is only necessary to move the remotely positioned brake handle control member **150** to the emergency brake position #2 (Fig. 2) so that the cam **151** will operate the switch **110** and open the normally closed contacts **111**, thus removing the holding ground that had been established through contacts **131** and **141** to hold the operated ones of relays **1–8** in their operated condition. Thus, when the brake handle **150** is moved to the emergency brake position, any operated ones of the control relays **1–8** are immediately deenergized and any of the contacts **15**, **25**, **35**, **45**, **55**, **65**, **75**, **85**, which may have been closed, are opened to disconnect the power supplied to the model railroad track and train so that the model train comes to an immediate stop due to its internal friction.

The above described operation of the control system provides a continuous speed coasting effect and an emergency or immediate braking effect. The invention may also provide for a gradually decreasing coasting speed and a graduated decreasing braking speed. The decreasing coasting speed arrangement will be described first.

It will now be assumed that the brake handle control member **150** is in the intermediate or solid line position, shown by Fig. 2 of the drawing, so that switches **110**, **140** and **160** are in their normal unoperated position with contacts **110**, **161** and **142** closed and contacts **141** opened. The positive terminal of the power supply is thus connected through normally closed contacts **111** and **142** and through normally closed contacts **132** of relay **130** to the lower winding **130*a*** of relay **130** and the negative terminal of the power supply. The upper winding **130*b*** of relay **130** is connected from the positive terminal of the power supply through capacitors **170** and **171** in parallel to the lower winding **130*a*** and the negative terminal of the power supply, assuming switch **160** to be in the normally closed position. The connection of the capacitors **170** and **171** and the windings **130*a*** and **130*b*** for relay **130** are such that relay **130** functions as a pulsing interrupter relay to periodically open contacts **131**, **132** and close contacts **133**. Contacts **131** and **133** are so arranged that contacts **133** close before contacts **131** open. The values of the capacitors **170** and **171** are chosen to provide a fairly slow pulsing rate for the pulsing or interrupter relay **130** so that it pulses at about the rate of six pulses per minute.

Now assuming that the controller member or handle **100** had been advanced to operate all the control relays **1–8** and thereby apply full power for full speed operation of the model railroad, when the control handle **100** is returned to the starting position all of the control relays **1–8** are initially locked in their operated positions assuming that at that moment the interrupter relay is operated so that contacts **133** are closed and contacts **131** are opened. When the interrupter relay **130** releases, contacts **133** will be opened and contacts **131** will be closed to release relay **8**. Relay **8** in releasing opens contacts **82** and **83** and closes contacts **81** thereby transferring relay **7** from the former locking circuit through previously closed contacts **83** to the substitute locking circuit through now closed contacts **81** and normally closed pulsing contacts **131**. When the pulsing or interrupter relay again operates, contacts **133** are closed and contacts **131** are opened to release relay **7** thereby opening contacts **72** and **73** and closing contacts **71** to transfer relay **6** from the previous holding circuit through formerly closed contact **72** to the substitute holding circuit through now closed contacts **71** and operated contacts **133**. This operation continues as the pulsing relay **130** pulses to progressively release the previously operated control relays **8–1** thereby gradually reducing the power applied to the model railroad track and train and providing a coasting decelerating effect for the train. It should be noted that should the controller handle **100** have been returned from the maximum power position to an intermediate position, then the previously operated maximum power relays would be pulsed off by the pulsing relay **130** but the remaining control relays, including the one corresponding to the position to which the control handle is then operated, will remain operated. Obviously, the coasting deceleration rate at which the control relays **8–1** are pulsed off is determined by the speed of operation of the pulsing relay **130** which may be suitably determined by the values of the capacitors **170** and **171**. In place of the pulsing relay **130** for operating contacts **131** and **133**, it should be apparent that a motor driven interrupter cam or other pulsing device may be used without departing from the spirit of the invention.

In order to provide a high speed rate for deceleration to simulate the application of braking to a degree less than the emergency brake previously described, the brake handle control member **150** may be moved to the brake position #1 whereby the cam **151** operates switch **160** to open the normally closed switch contacts **161** and thereby disconnect capactior **171** from the interrupter circuit for the interrupter relay **130**. The disconnection of the capacitor **171** in the interrupter circuit has the effect of increasing the speed of operation and release for pulsing interrupter relay **130**. This increasing speed of operation will cause the control relays **8–1** to be pulsed off at an increased rate of speed after the control handle **100** is moved to the off position or a lower position than to which it was previously operated. Of course, when using a motor drive interrupter in place of the relay **130**, the operation of the switch **160** by the brake handle **150** may be effective to increase the speed of the motor driven interrupter. Also it should be understood that a variable control, such as a rheostat, may be used in place of switch contacts **161** to progressively vary the pulsing speed as the brake handle is moved.

It should be obvious that the system of the invention is not limited to a particular number of control relays or control steps for the remote speed controller. Nor is it limited to a total number of brake positions for the brake simulation handle. It will also be noted that each of the relays **1–8** is provided with shunting resistors **1*a*–8*a***. These resistors function to slightly delay the release of each of the associated relays and assure that the relays of the chain will be released in succession by the operation of the interrupter contacts **131** and **133**. Obviously, slow release relays may be used in which case resistors **1*a*–8*a*** are not required.

Various modifications may be made within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. An electric motor control system comprising, a control member movable progressively between Off and On positions, first circuit means controlled by said member to be energized to connect power to the motor in increasing amounts in response to movement of said member progressively to the On position, time delay circuit means having an electrical time constant, said time delay circuit means energized together with the energization of said first circuit means and connected to additionally control said first circuit means to gradually reduce the amount of power coupled to said motor at a rate determined by said time constant as said member is moved toward the Off position.

2. An electric motor control system comprising, a first control member movable progressively between Off and On positions, a second control member movable between first and second positions, first circuit means controlled by both said first and second members to connect power to the motor in increasing amounts in response to movement of said first member progressively to the On position while said second control member is at a predetermined one of said first and second positions, time delay circuit means having an electrical time constant, said time delay circuit means controlled by both said first and second members and connected to said first circuit to gradually reduce the power coupled to said motor at a rate determined by said time constant in response to movement of said first member toward the Off position while said second member is at the predetermined one of said first and second positions, and means to disconnect power from the motor in response to movement of said second member to the other of said first and second positions regardless of the position of said first member.

3. An electric motor control system comprising, a first control member movable progressively between Off and On positions, a second control member movable between first and second positions, first circuit means controlled by said first member to connect power to the motor in increasing amounts in response to movement of said first member progressively to the On position, time delay circuit means having an electrical time constant, said time delay circuit means controlled by both said first and second members and connected to said first

circuit to gradually reduce the amount of power coupled to said motor at a rate determined by said time constant in response to movement of said first member toward the Off position while said second member is at a predetermined one of said first and second positions, and means to change the electrical time constant of said time delay circuit in response to movement of said second member to the other of said first and second positions.

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