United States Patent

[11] 3,553,450

[72] Inventor **Max Ernst**
14 Lohengrinstrasse, 85 Nuernberg, Germany

[21] Appl. No. **746,966**
[22] Filed **July 23, 1968**
[45] Patented **Jan. 5, 1971**
[32] Priority **July 25, 1967**
[33] **Germany**
[31] **No. E34456**

[54] **DEVICE FOR ELECTRIC TOY AND MODEL RAILROAD INSTALLATION FOR CONTROLLING THE OPERATION OF VEHICLES THEREON**
8 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **246/32,** 104/153; 246/187
[51] **Int. Cl.** **B61l 21/10**
[50] **Field of Search** ..... 104/153; 46/216, 243; 246/59, 74, 87, 58, 52, 41, 167D, 187G, 75, 175, 179, 479, 20, 128, 72—92, 31, 82; 318/16; 191/15

[56] **References Cited**

UNITED STATES PATENTS

2,227,411 12/1940 Jones 246/32

OTHER REFERENCES

Westcott, L. H. Model Railroader July, 1964 p.45.

Primary Examiner—Arthur L. La Point
Assistant Examiner—George H. Libman
Attorney—Walter Becker

ABSTRACT: A block signal system for controlling the automatic operation of two locomotives in electric toy and model installations wherein the head of each block section, preferably provided with a signaling post, has an insulated track portion which is long enough so that a train with a locomotive arriving on the track portion at full speed is stopped ahead of the signaling post. The insulated track portions are connected to contact free electronic switches, particularly transistors which are placed under voltage while the control electrodes are connected through resistors to the rail portion of the respective preceding block section. If more than three block sections are provided they are connected to the insulated track portions associated with the block sections located farther back by two steps. The resistors preceding the control electrodes are selected so that the control current passing through a locomotive motor winding opens the corresponding electronic switches but does not put the locomotive motor into motion.

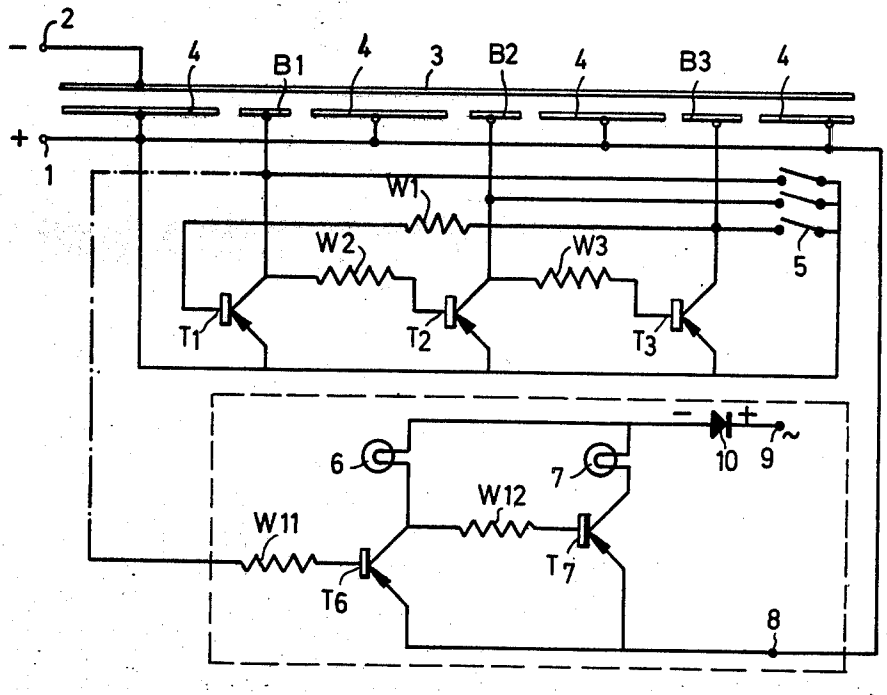
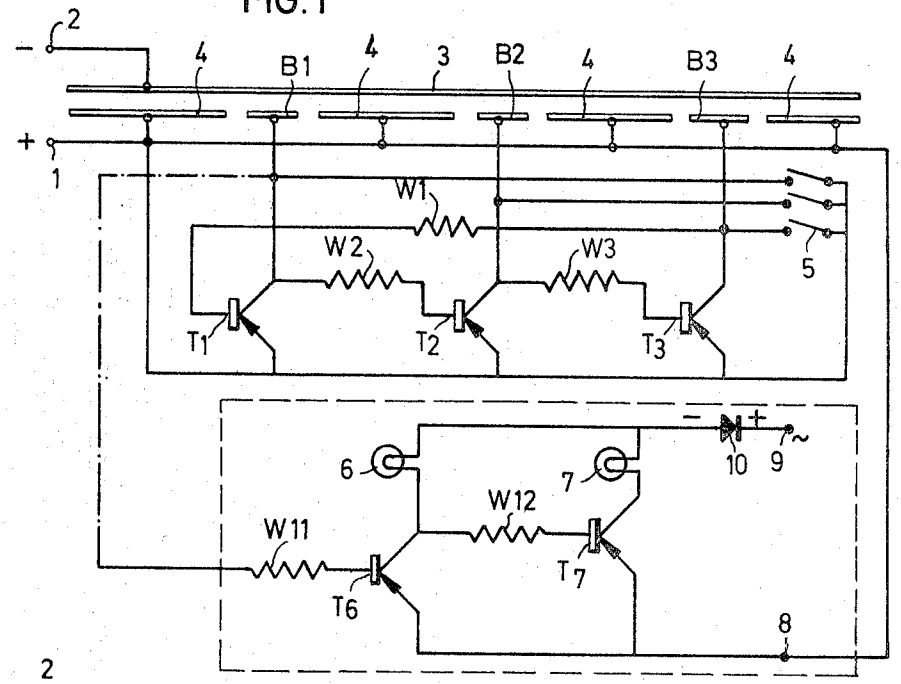


FIG. 1



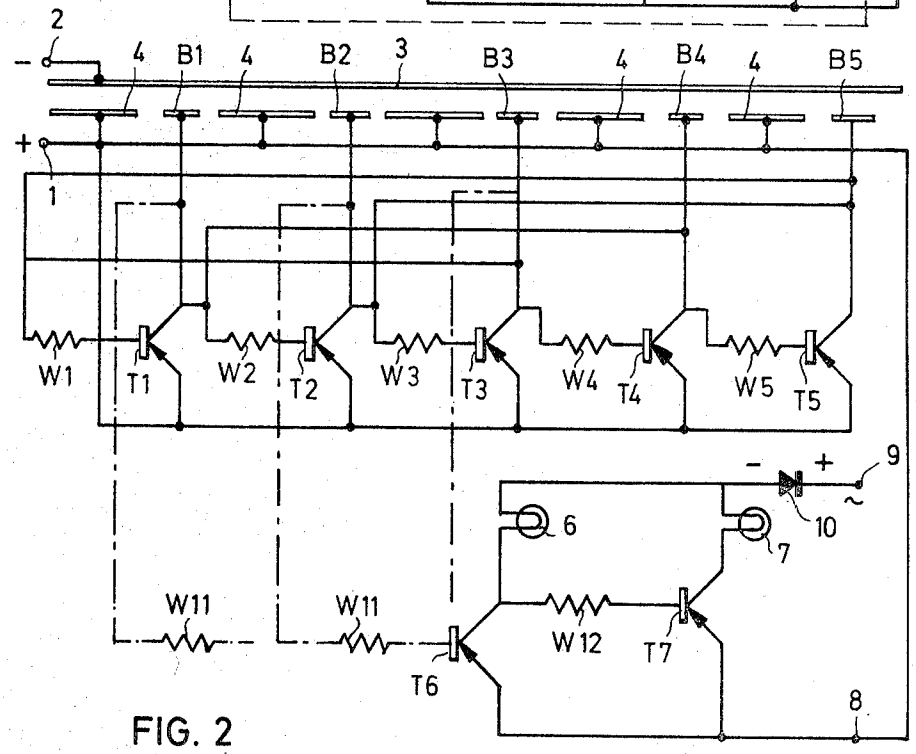


FIG. 2

INVENTOR

Max Ernst

BY

Walter Burky

DEVICE FOR ELECTRIC TOY AND MODEL RAILROAD INSTALLATION FOR CONTROLLING THE OPERATION OF VEHICLES THEREON

The present invention concerns a device for electric toy and model railroad installations for controlling the operation of vehicles thereon.

For reasons of safety, in actual railroad operations, the so-called block section-operation has been introduced. The railroad section over which two or more trains run in the same direction is subdivided into sufficiently long so-called block sections which are adapted to be blocked and released by signals at the start of the block sections. For the time period during which a train passes over such block section, the entrance signal pertaining thereto is switched to red, and is switched over to green only, i.e. is released or freed for the passage of another train, when the preceding train has left this block section. This will assure that between two succeeding trains there will always be maintained a sufficiently large safety distance.

The toy imitation of such normal block operation is, of course, possible but is made difficult due to the fact that with toy railroad installations, as a rule, a closed and generally not very long railway section is passed over by at least two trains in the same direction while as a rule, there exists the requirement that the driving operation should be possible automatically.

Devices of this type, therefore, can be produced only at relatively high expense and, therefore, are not suitable for mass production.

It is, therefore, an object of the present invention to provide a device for use in connection with electric toy and model railroad installations for automatically running the installation in block section-operation, which will overcome the above-mentioned drawbacks.

It is another object of this invention to provide a device as set forth in the preceding paragraph, which is simple in construction, can be produced at low cost, and will meet the requirements for automatically running the driving operation.

It is another object of this invention to provide a device according to the preceding paragraphs, which will make it possible to run two trains simultaneously on a closed railway track without running the risk of collision.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which:

FIG. 1 illustrates the electric diagram for the block section-operation of a direct current operated installation for electric toy and model railroad installations with three block sections, and also illustrates the circuit of one of the three signal devices; and

FIG. 2 is a circuit similar to that of FIG. 1 but for five block sections.

An arrangement according to the present invention is characterized by the following features:

a. In front of each block section which, preferably at the start thereof is provided with a signalling post, there is located a track section which is not connected to the driving voltage feeder line and the length of which is so selected that even a train which at full speed with the locomotive moves on the said track section, will come to the stop on said track section ahead of the location of the signal.

b. Those track sections which are not connected to the driving voltage feeding line are adapted to be placed under voltage by means of contact-free electronic switches, especially transistors, while the control electrodes of these switches, through the intervention of resistors, are conductively connected to the rail section which is not under driving voltage and pertains to the respective rearwardly located block section, and if more than three block sections are provided, is connected also to the track section which is not under driving voltage and belongs to the block section which is two steps ahead.

c. The resistors preceding the control electrodes and pertaining to the contact-free electronic switches are so dimensioned that the control current passing through the motor winding of the employed locomotives, or the control voltage occurring in this connection will open the respective electronic switch which, however, is not yet put into operation by the motor through which the control current passes.

Advantageously, each of the provided block sections will at the start thereof be equipped with a signalling device, especially a signal post adapted to emanate a red light signal and a green light signal. According to a further feature of the invention, each block section is equipped with a contract-free operating signalling device adapted to send a red signal and a green signal.

To this end, two incandescent lamps are provided of which one gives off the red signal, and the other gives off the green signal. Both incandescent lamps are so arranged in a monostable sweep circuit formed by two transistors that the incandescent lamps giving off the red signal are located in the stable branch of the sweep circuit, whereas the incandescent lamp giving off the green signal is located in the unstable branch of the sweep circuit.

The control electrode of the electronic switch, especially the transistor, giving off the red signal is through the intervention of a suitably dimensioned resistor connected to the voltage electrode (collector) of the electronic switch giving off the green signal, that while a sufficient control voltage is furnished for opening the switch associated with the red signal, the incandescent lamp giving off the green signal will not be illuminated. The electronic switch giving off the green signal is, through a suitably dimensioned resistor connected to the railway track which does not receive driving voltage and pertains to the preceding block section. For purposes of feeding the signalling device, alternating current may be employed, for instance, the secondary voltage (approximately 16 volt) of the transformer necessary for the driving operation, while a diode interposed in the feeding line brings about the necessary rectification.

According to a further feature of the invention, the installation may be provided with a switch by means of which those railway sections which are provided in insulated condition for carrying out the block section-operation are connected directly to the driving voltage whereby the block section-operation is eliminated. In this instance, all of the signalling devices will be red similar to the actual driving operation in actual railroad operations.

Referring now to the drawings in detail, the invention will now be described specifically in connection with a toy railroad installation which comprises two rails insulated relative to each other and in which the driving operation is effected by locomotives equipped with direct current motors while a direct voltage variable from 0 to 12 volts is conveyed to the two rails, preferably through the intervention of a control transformer. However, as mentioned above, the invention can also be applied to different installations, for instance, with an overhead wire, or to alternating current driven installations.

More specifically, network lines 1 and 2 lead to a control transformer and convey a direct voltage which is variable at will. The two rails of the railway installations are designated with the reference numerals 3 and 4 and form a track closed in itself. The entire track is subdivided into three block sections while at the start of each block section there is provided a signalling post (not shown) with a green and a red signal. Ahead of each of said posts, the track comprises a section B1, B2 and B3 insulated from the rail 4. The length of these sections B1—B3 is so selected, for instance, 10 to 20 centimeters, that even a train moving with its locomotive at full speed on the respective section, will be stopped ahead of the drive-in signal. These rail sections B1—B3 are respectively connected to the plus-pole of the feeding line 1 through the collector-emitter section of a PNP transistor T1—T3. The base of the transistor T1 is electrically conductively connected to the rail

section B3 through a resistor W1. The base of the transistor T2 is electrically conductively connected to the rail section B1 through the intervention of a resistor W2, and the base of the transistor T3 is electrically conductively connected to the rail section B2 through the intervention of a resistor W3. If no block operation is desired, switch 5 will be actuated, by means of which all of the rail sections B1, B2 and B3 are directly connected to the plus-pole 1.

In order to be able to carry out an automatic driving operation with two locomotives, it is necessary to select the resistors W1—W3 of such magnitude that when one locomotive moves onto one of the three block sections B1, B2 or B3, the control voltage produced on said transistors T2, T3, T1 will render these transistors conductive while the current passing through the motor windings of the locomotives, however, remains so low that the locomotives cannot start moving. On the other hand, the fact that the transistors T1—T3 become conductive brings about that the locomotive which is stopped on the respective block section will receive the full operative voltage, so that it will be able definitely to start and after a short drive will move onto the rails 3 and 4 and will be kept in operation by the respective selected driving voltage. The block driving operation is therefore effected in the following manner:

Locomotive 1 has been stopped on section B2. Locomotive 2 passes through the block section between B3 and B1. When locomotive 2 moves onto the section B1, it will be stopped. Through the motor winding of locomotive 2 and the resistor W2, the transistor T2 will be rendered conductive. At the winding of the motor of locomotive 1 there will thus exist the driving voltage. Locomotive 1 thus moves to B3 whereas locomotive 2 remains on section B1. When locomotive 1 has arrived at the section B3, the transistor T1 is made conductive by the motor winding of locomotive 1 and the resistor W1 so that the motor of locomotive 2 now receives the full driving voltage and passes through the block section between B1 and B2, etc.

As mentioned above, each block section has at its entrance a signalling installation for producing a green and a red signal. The signalling is in conformity with the invention effected through two small incandescent lamps 6 and 7 which are fed from a suitable alternating current source 8, 9 through the intervention of a rectifier 10. As indicated in FIG. 1, the two incandescent lamps are respectively in series with the PNP transistors T6, T7 while the rectifier 10 is so poled that the two incandescent lamps with their common pole receive a negative voltage. The incandescent lamp 6 is intended for producing the green signal, whereas the incandescent lamp 7 is intended to produce the red signal. The second pole of the incandescent lamp 6 is connected to the collector of a transistor T6 and is furthermore through a resistor W12 connected with the base of a second transistor T7 the collector feeding line of which is connected to the second pole of the incandescent lamp 7. The two emitters of of the transistors T6 and T7 are connected to the contact 8 of the current feeding line. In the feeding line to the base of the transistor T6 there is interposed a resistor W11 through which the base is connected to the rail section B1. The incandescent lamps 6 and 7 connected to the transistors T6 and T7 in the illustrated manner form a monostable sweep circuit according to which, normally, the transistor T6 is blocked and the transistor T7 is opened. This is due to the fact that through the incandescent lamp 6 and resistor W12, the base of transistor T7 receives such a high negative voltage that the latter is made conductive. Consequently, the full voltage of operation exists on incandescent lamp 7 so that the red signal will be illuminated. The resistor W12 is selected of such a magnitude that the control current passing through incandescent lamp 6 will remain so low that the incandescent lamp 6 will not be illuminated.

The switch-over of the signalling device to the signal green will be effected when a locomotive has moved onto the railway section B1 and thus the transistor T6 through the motor winding and the resistor W11 receives a negative control voltage which renders transistor T6 conductive. It will be appreciated that now the full voltage of operation exists on incandescent lamp 6 which is illuminated, and that a positive control voltage exists at the base of the transistor T7, so that the incandescent lamp 7 will be extinguished. The resistance of W11 and W2 has to be selected so high that while the transistors T6 and T7 will be safely made conductive, the locomotive standing on section B1 and acted upon by the control current cannot yet move.

It should be borne in mind that the signalling installation connected to the rail section B1 is mounted toward the front by one block section, in other words, ahead of the rail section B2 so that when T2 releases a locomotive standing on B2 for a continued drive, the corresponding signalling device is switched over from red to green.

It will also be seen from the circuit that when closing the switch 5, not only will all of the transistors T1—T3 be put out of action but also the transistor T6 of the associated signalling installation will through W11 receive a positive voltage, so that all signals remain on red.

The illustrated installation intended for three block sections and correspondingly provided with three signalling installations may with larger railway installations analogously be expanded to more than three block sections. To this end, it is merely necessary to connect the base of the transistors intended for block operation not only to the rail section which pertains to the preceding block section and is not under driving voltage, but also additionally to conductively connect said base with the rail section receiving the voltage of operation and is located ahead by two block sections.

FIG. 2 illustrates an installation for a total of five block sections designed in the above-mentioned manner. According to FIG. 2 parts similar to those of FIG. 1 have been designated with the same references as in FIG. 1. Thus, there are additionally to be mentioned only the rail sections B4 and B5 with the corresponding transistors T4 and T5 and resistors W4 and W5. FIG. 2 furthermore shows that, for instance, the base of transistor T2 is through resistor W2 connected to the rail section B1 of the preceding block section, and to the rail section B4 of the second following block section. Similarly, the base of the transistor T3 is through resistor W3 connected to the rail sections B2 and B5, etc. In this way it is possible that the locomotive reaching section B1 causes the locomotive on section B2 to continue its drive and that, subsequently, the locomotive moving onto B3 brings up the locomotive standing on B1, etc. Otherwise, there is no difference between the installation of FIG. 2 over that of FIG. 1 with three block sections. Also the signals are arranged offset by one step toward the front with regard to the rail section controlling said signals. By means of a switch 5 not illustrated in FIG. 2, it is possible also in this instance to render the block operation ineffective while all signal installations are switched over to red.

As will be evident from the above, the installation according to the present invention is particularly simple when operating the installation with direct current while the driving voltage is conveyed to the two rails insulated relative to each other. As mentioned above, the invention can also be used in connection with other systems, for instance, with a system according to which the voltage of operation for the locomotive is on one hand conveyed through the two rails, and on the other hand through a wire. As will also be evident from the above, the installation according to the invention can be operated with alternating current, and is particularly simple when installations are employed in which the locomotives are provided with rectifier means and only one-half wave of the fed alternating voltage is taken advantage of.

It is, of course, to be understood, that the present invention is, by no means, limited to the specific arrangement shown in the drawing, but also comprises numerous modifications, the scope of the invention being determined by the appended claims.

I claim:

1. A block signal system for contact-free controlling of the operation of a plurality of toy trains having DC electric motors

actuated by a driving voltage from means comprising a first conductor and a second conductor, said system comprising $2n - 1$ block sections wherein n is an integer greater than 1 and each section has a transistor with a collector connected to an insulated portion of said first conductor, an emitter connected to said first conductor and a base connected to a resistor which in turn is connected to another insulated portion of said first conductor and the collector of another transistor.

2. The block signal system of claim 1, wherein there are three block sections comprising a first section having a first transistor with a first collector connected to said means further comprising a first insulated portion of said first conductor, a first emitter connected to said first conductor and a first base connected to a first resistor; a second section having a second transistor with a second collector connected to a second insulated portion of said first conductor, a second emitter connected to said first conductor and a second base connected to a second resistor which in turn is connected to said first collector; and a third section having a third transister with a third collector connected to a third insulated portion of said first conductor and said first resistor, a third emitter connected to said first conductor and a third base connected to a third resistor which in turn is connected to said second collector.

3. The block signal system of claim 1 wherein there are five block sections progressively and structurally comprising a first section having a first transistor with a first collector connected to a first insulated portion of said first conductor, a first emitter connected to said first conductor and a first base connected to a first resistor; a second section having a second transistor with a second collector connected to a second insulated portion of said first conductor, a second emitter connected to said first conductor and a second base connected to a second resistor which in turn is connected to said first collector; a third section having a third transistor with a third collector connected to a third insulated portion of said first conductor and said first resistor, a third emitter connected to said first conductor and a third base connected to a third resistor which in turn is connected to said second collector; a fourth section having a fourth transistor with a fourth collector connected to a fourth insulated portion of said first conductor and said second resistor, a fourth emitter connected to said first conductor and a fourth base connected to a fourth resistor which in turn is connected to said third collector; and a fifth section having a fifth transistor with a fifth collector connected to a fifth insulated portion of said first conductor and said first and third resistors, a fifth emitter connected to said first conductor and a fifth base connected to a fifth resistor which in turn is connected to said fourth collector.

4. The block signal system of claim 1 further comprising a contact free signal installation associated with each block section, respectively including alternately driving and nondriving sections.

5. The block signal system of claim 4, wherein said signaling installation includes a monostable sweep circuit comprising two transistors, said sweep circuit having both a stable branch with means for generating a red signal and an unstable branch with means for generating a green signal alternately of each other.

6. The block signal system of claim 5 wherein the first of said sweep circuit transistors has a base connected to a resistor which in turn is connected to said insulated portion, a collector electrode connected to said means for generating a green signal, and first and second sources of alternating current, and an emitter connected to said second source of alternating current, and the second of said sweep circuit transistors has a base connected to a resistor which in turn is connected to said collector of the first sweep circuit transistor, a collector connecting said means for generating a red signal and said first source of alternating current and an emitter connected to said second source of alternating current.

7. The block signal system of claim 6 wherein the resistances of said resistors of the sweep circuit transistors are selected so that a control current is limited to be insufficient to bring about illumination of said means for generating a green signal and is unable to activate the motor producing said signal.

8. The block signal system of claim 7 wherein the emitters and collectors of said sweep circuit transistors are activated selectively by an alternating current through a diode.