C. E. BALZER.

RAILWAY SYSTEM.

APPLICATION FILED APR. 24, 1913

1,097,160.

Patented May 19, 1914.

3 SHEETS—SHEET 1.

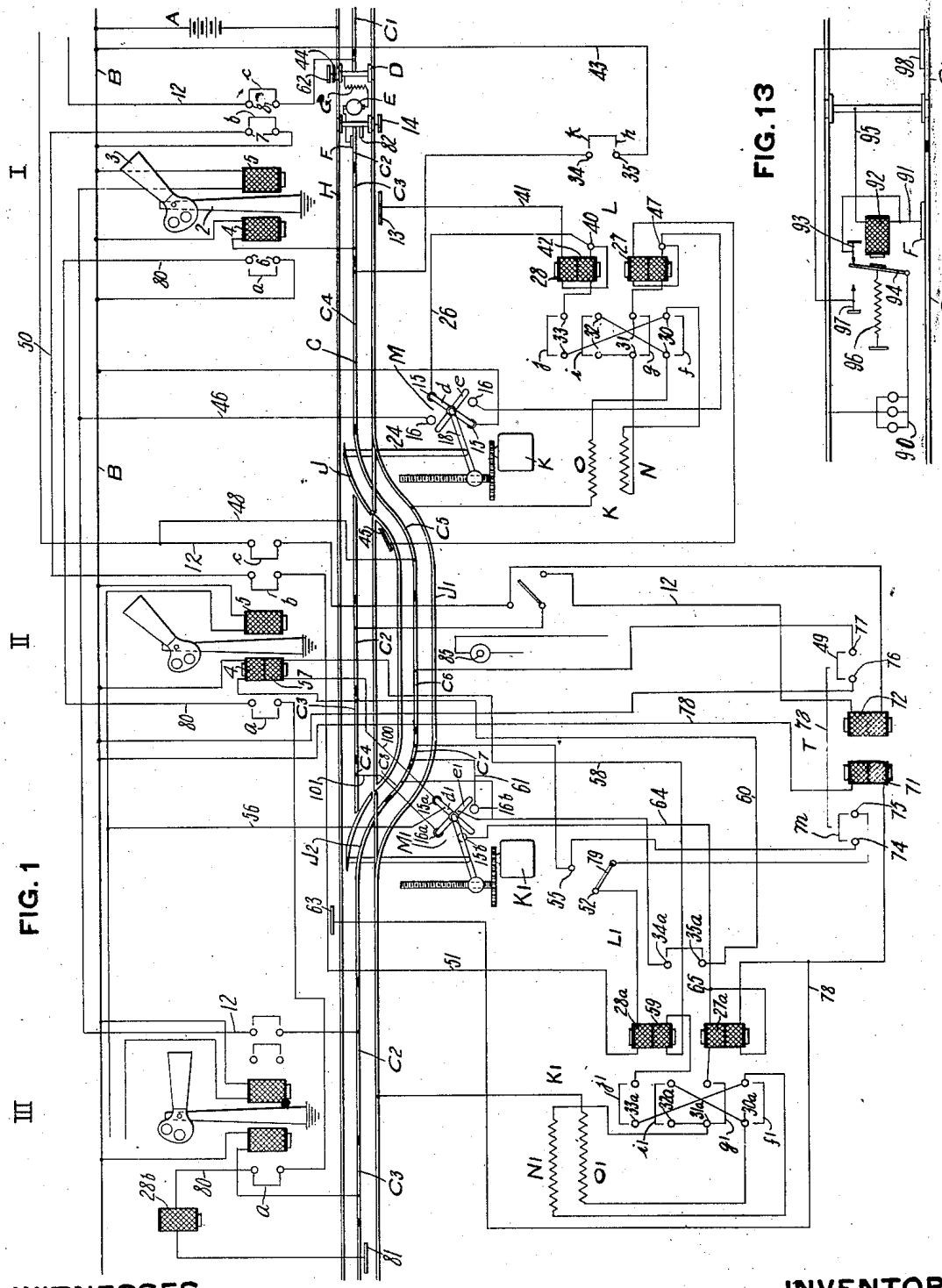


FIG. 1

FIG. 13

WITNESSES

W. T. Holman

Elbert L. Hyde

INVENTOR

Charles E. Balzer.

By Fredk W. Mueller

Attorney

C. E. BALZER.

RAILWAY SYSTEM.

APPLICATION FILED APR. 24, 1913.

1,097,160.

Patented May 19, 1914.

3 SHEETS—SHEET 2.

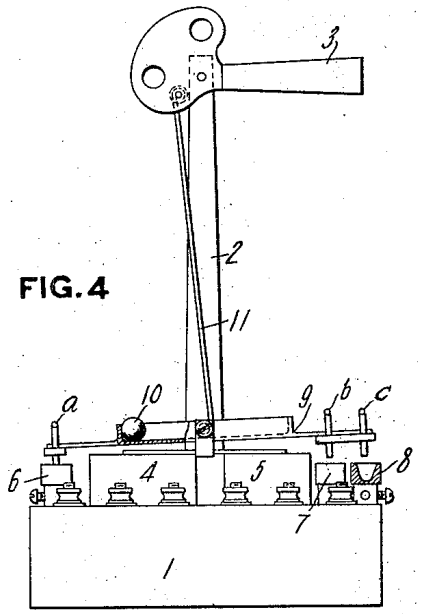


FIG. 4

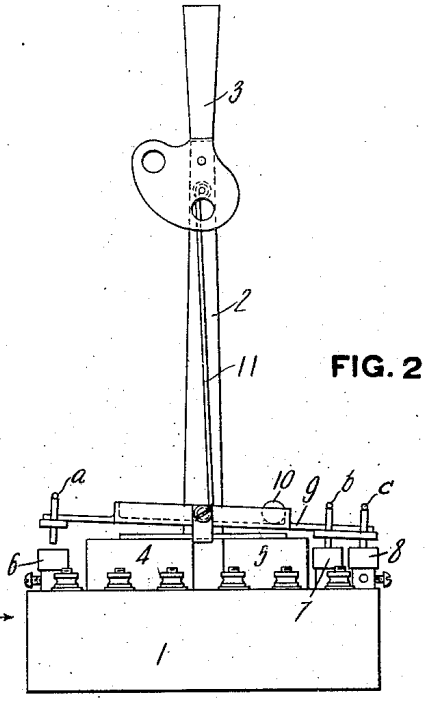


FIG. 2

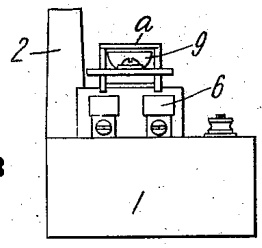


FIG. 3

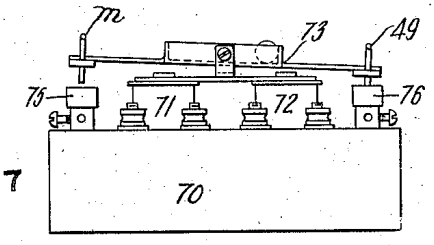


FIG. 7

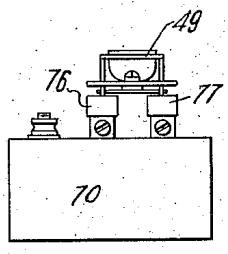


FIG. 8

WITNESSES

W. T. Holman

Elbert L. Hyde.

INVENTOR

Charles E. Balzer.

By Fredk W. Wiles

Attorney

C. E. BALZER.

RAILWAY SYSTEM.

APPLICATION FILED APR. 24, 1913.

1,097,160. Patented May 19, 191

3 SHEETS—SHEET 3.

FIG. 9

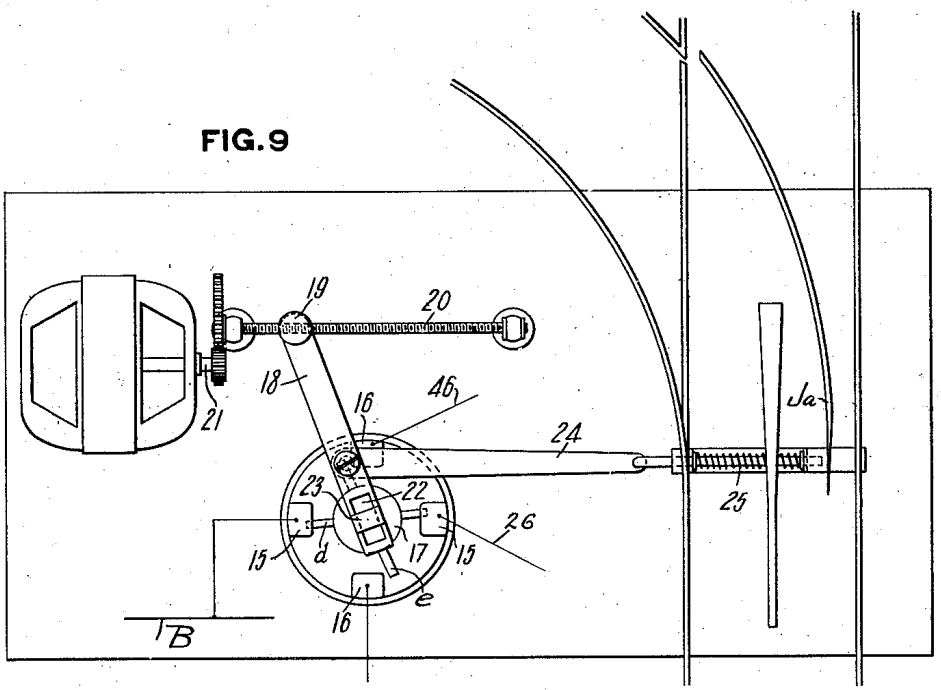


FIG. 11

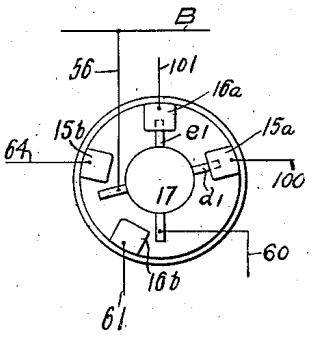


FIG. 6

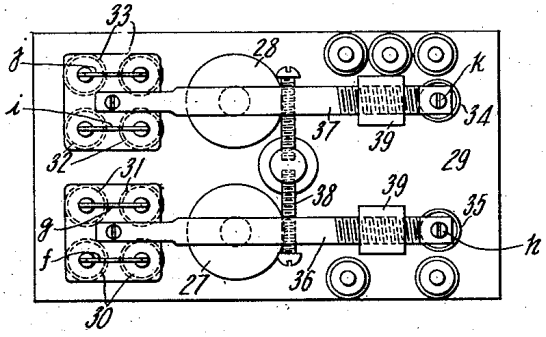
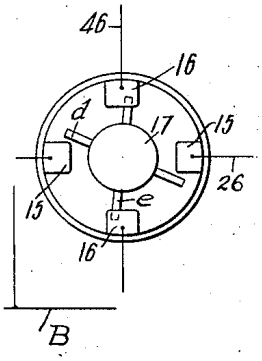


FIG. 10



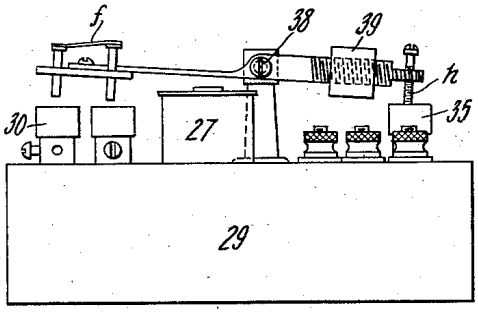


FIG. 5

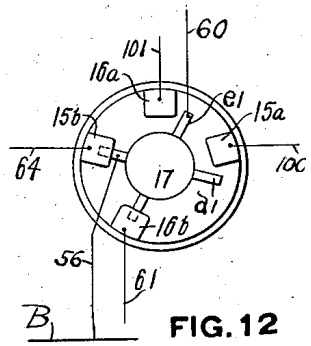


FIG. 12

WITNESSES

W. T. Holman

Elbert L. Hyde

INVENTOR

Charles E. Balzer,

By Fredk W. Winter

Attorney

UNITED STATES PATENT OFFICE.

CHARLES E. BALZER, OF McKEES ROCKS, PENNSYLVANIA.

RAILWAY SYSTEM.

1,097,160. Specification of Letters Patent. Patented May 19, 1914.

Application filed April 24, 1913. Serial No. 763,392.

To all whom it may concern:

Be it known that I, CHARLES E. BALZER, a resident of McKees Rocks, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Railway Systems, of which the following is a specification.

This invention relates to electric railway systems, and particularly to toy, display or carrier systems, in which all of the mechanism is operated by the propulsion current.

The object of the invention is to provide an automatic electric railway system embodying a block signal system controlled or operated by the propulsion current and arranged to prevent succeeding cars from running into each other.

A further object of the invention is to provide an electric railway system embodying automatically controlled or operated track switches arranged to switch the trains into the sidings, said switches being operated by the propulsion current, and closing to again connect up the main line after a car has entered a siding.

A further object of the invention is to provide a system of the character described in which certain cars or trains can be switched into a siding to permit other following cars or trains to overtake and pass, at the siding, the car which has been switched thereinto.

A further object of the invention is to provide a system in which under certain conditions a following train, such as a passenger train, will close a circuit or circuits, thereby causing a train ahead on the main line to automatically open and take a switch into a siding.

A further object of the invention is to provide a system in which the supply of current to a train standing on a siding, for propelling the same out upon the main line, is controlled by a following train on the main line, which closes the branch current supply circuit to the train on the siding in passing the siding on the main line.

A further object of the invention is to provide an electric railway system suitable for use as an automatic conveying or carrying system, and in which the cars automatically move along the main line and can be brought to rest selectively at any one particular station or siding on the main line, and can then be returned when desired to the starting point.

Further objects of the invention are in part obvious and in part will appear hereinafter.

In the drawings Figure 1 represents diagrammatically a system embodying the invention; Fig. 2 is an enlarged detail view of a semaphore and circuit controlling member, the parts being shown with the semaphore in the "green" position; Fig. 3 is a detail end view, partly in section, from the left in Fig. 2; Fig. 4 is a similar view showing the semaphore in "red" position; Fig. 5 is a side elevation of a railway switch controlling member; Fig. 6 is a plan view thereof; Fig. 7 is a side elevation of another circuit controlling member; Fig. 8 is an end view thereof; Fig. 9 is an enlarged plan view of a track switch, and mechanism for controlling or operating the same; Fig. 10 is a detail view, showing a different position of the electric switch illustrated in Fig. 9; Figs. 11 and 12 are similar views of another electrical switch; and Fig. 13 is a diagrammatic view of the lighting circuits.

The system shown in the drawings is of the third rail type, in which the propulsion current is collected from a third rail divided into sections, transmitted through the car motor and returned by way of the track rails. As illustrated, the system is operated by a source of current A, such as a battery or generator, which is connected to a feed conductor B extending along the full length of the track and sidings, and which supplies current to the several sections of the third rail C.

The car is represented diagrammatically at D and embodies one or more motors E of any suitable type and supplied with current from a collector or shoe F traveling along the third rail C.

G represents the field winding of the motor, through which the current is transmitted to the frame of the car D and then to the return track rail or rails H.

At each block or section of the main line, three being shown, is located a semaphore and circuit controlling member, having an arm controlled by two electromagnets, said magnets also controlling several circuits in the system and hereinafter referred to more in detail.

J represents a railway track switch leading into a siding J', said track switch J being operated by a motor K. The circuits to this motor are controlled by the duplex

electromagnet L, shown in detail in Figs. 5 and 6.

Third rail C is divided into a plurality of sections, marked respectively "C^1," "C^2," "C^3," "C^4," etc., and referred to separately hereinafter. Each of said sections of the third rail is supplied with current by a circuit leading from the feed wire B.

Assuming that the car D, shown in Fig. 1 is traveling along the track from right to left, and that all blocks ahead of the car are clear, it will be propelled along section C^1 and will then pass over the break onto section C^2. Semaphore I is at the "green" or safe position and current is consequently being supplied to section C^2, the semaphore and circuit controller being constructed and arranged as follows: As shown in Figs. 2, 3 and 4, it comprises a base 1 on which is mounted a post or pillar 2 supporting a semaphore arm 3 of the usual type. On the base are mounted two electromagnet coils 4 and 5. One end of said base carries a pair of mercury cup contacts 6. At the other end of said base are mounted two pairs of similar contacts, marked "7" and "8," respectively. Above the magnets 4 and 5 is mounted a horizontal pivoted switch arm 9 carrying bridges *a*, *b* and *c* insulated from said arm and having end contact points adapted to enter the mercury in the cups. The middle portion of arm 9 is hollowed or channel-shape in cross section to carry a rolling ball or weight 10. Whenever either end of said arm is depressed by operation of one of the magnets 4 or 5 the ball 10 rolls to that end of the arm and holds it by gravity in its new position. Said arm 9 is connected to operate the semaphore arm 3 by means of a rigid arm 11 securely attached to arm 9 and loosely pivoted to the semaphore arm at its upper end.

Section C^2 of the third rail at each block is supplied with current by a circuit 12, the wire of which includes the coils of the magnet 5 of a first, second or any other previous block, being shown as connected to the coil of the second block. Section C^3, which is next beyond C^2, is supplied with current through a branch circuit including the coil of magnet 4 of the immediate or nearest block. Whenever magnets 4 are operated they turn the semaphores to "red" position, closing contacts 6 and breaking contacts 7 and 8, thereby cutting off the supply of current to the section C^2 of the immediate block and preventing a following train from passing the same. Whenever magnets 5 are operated by a train passing the second block ahead the semaphores are turned to "green" position, thereby completing the feed circuit to section C^2 and allowing a following train to advance. Semaphore I being in the position shown in Fig. 2, bridge *c* completes circuit 12 and the car travels along section C^2 until it reaches section C^3.

At one side of the track, along section C^3, is located a contact 13, adapted to be contacted by an adjustable contact member 14 on the car or train D. A similar contact is located in advance of every siding, the contacts for the different sidings being located at different distances from the track. Contact 14 is located or adjusted upon the car at the proper distance to one side to strike the desired track contact 13 or the like, so as to switch the car into any desired siding. When the car contact 14 strikes the track contact 13 a circuit is completed through one coil of the electromagnet L, which controls an electric switch M and the circuits through the track switch operating motor K. Switch M and the parts controlled thereby are arranged as follows: The switch comprises two pairs of oppositely disposed contacts 15 and 16, the oppositely disposed contacts being adapted to be connected by bridge arms *d* and *e* mounted to rotate together on a pillar or support 17, the bridge arms being insulated from each other. Arms *d* and *e* are operated by a lever 18, one end of which is pivotally connected to a nut 19 which travels along a screw 20 connected by suitable gearing to the armature shaft 21 of motor K. Lever 18 is slotted at 22 to fit and slide on a squared member 23 connected to the two bridge arms *d* and *e*. A link 24 connects lever 18 to the movable member J^a of track switch J, a spring 25 being preferably inserted between link 24 and member J^a. A conductor 26 is connected to one contact 15, while the other contact 15 is connected to a branch from the feed wire B. In the position of the switch shown in Figs. 1 and 9 arm *d* bridges the contacts 15 and connection is made through the switch from the feed wire B to the conductor 26. The track switch J is also in closed position.

The circuits to the motor K for operating the track switch and electrical switch M are controlled by the electromagnet L, shown in detail in Figs. 5 and 6 and arranged as follows: Two electromagnet coils 27 and 28 are mounted side by side on a base 29, having four pairs of mercury cup contacts 30, 31, 32, 33 at one end and two mercury cup contacts 34, 35 at the other end. Over the magnets are mounted two pivoted arms 36 and 37. One end of arm 36 carries two insulated bridges *f* and *g*, which respectively bridge the pairs of contacts 30, 31. The other end of said arm carries a single contact member *h*. Arm 37 at one end carries two insulated bridges *i* and *j* and at the other end a single contact *k*. Both arms swing on the same pivot 38 and are provided with adjustable weights 39, to normally raise all of the bridges *f*, *g*, *i* and *j* from contacts 30, 31, 32, 33.

When car contact 14 strikes contact 13 a circuit is completed from the feed wire B to contact 15, through bridge *d*, conductor 26 to the point 40, through one winding of magnet 28 and then through wire 41 to contacts 13, 14 and to the negative or return track rail. Arm 37 is pulled down, and the bridges *i* and *j* connect up the contacts 32 and 33. Consequently current also flows from the point 40, through a second winding 42 of magnet 28, thence across bridge *j*, to a contact 30, through the field winding N of motor K, then to a contact 31, thence across to the other pair of contacts 32, through bridge *i*, thence to the other contact 30, thence through the armature winding O of motor K, and then to negative or to the return track rails. Motor K therefore begins to operate, rotating the screw 20 and causing the nut 19 to travel therealong. This oscillates arm 18 and bridge arm *d* begins to rotate around pillar 17 as an axis. Link 24 also moves the movable switch member J^1 toward open position. This motion continues until the track switch is fully opened, at which time arm *d* moves out of contact with contact members 15, thus breaking the circuit to the motor K from contact 15. Both circuits through the coils of magnets 28 are broken so that arm 37 drops and its contact *k* enters mercury cup 34. Some time before the contacts 15 are broken arm *e* strikes contact 16, as shown in Fig. 10, and bridges the same. This leaves the switch in condition for later operation when the car strikes contact member 45, as hereinafter described, to close the track switch.

The section C^4 of the third rail is supplied with current through the cup contacts 34 and 35 in wire 43, leading from the feed wire B. These contacts are controlled by the arms 36 and 37 as follows: Referring to Figs. 1 and 6, the current travels from the feed wire to contact 35, thence into arm 36, thence across the pivot rod 38 for the arms 36 and 37, thence through arm 37 to contact 34, and then to the section C^4. If either one of the magnets 27 or 28 is energized one of the contacts 34 or 35 is broken, thereby cutting off the feed to section C^4. This protects the car and prevents it from passing over the switch J at any time when the same is being thrown by motor K. When magnet 28 is operated to start the switch operating motor the feed to section C^4 is broken and the train comes to rest on said section of the track. It remains there until switch J is fully open, when the circuit 43 will again be completed and the car be supplied with current. The car now moves along and enters the siding J^1 through switch J. The rear end of the car or train is provided with a side contact 44 adapted to make contact with track contact member 45, when the train has fully entered the siding. This completes a track switch motor circuit as follows: From the feed wire B through coil 5 of the next previous semaphore I, consequently moving the semaphore arm to "green" position and closing its feed circuit 12,—thereby feeding section C^2 and permitting a following train to go ahead over the main line,—then through conductor 46, and to one contact 16 of switch M. In the open position of track switch J arm *e* bridges contacts 16. The current consequently flows across bridge arm *e* thence to the point 47 and through a winding of magnet 27, thence to contact 45 and to the return rail. Arm 36 is pulled down, bridging all the contacts 30 and 31. Current thereupon also flows from the point 47 through the other winding of the magnet 27, then across the bridge *g*, through the field winding N of motor K, but in the opposite direction from before, then to a contact 30, through the bridge *f* and through the armature winding O to the return rail, and in the same direction as before. The direction of rotation of the rotor of motor K is consequently reversed and the movable switch member J^a is closed. Arms *d* and *e* of the switch M are returned to their former positions, consequently restoring the circuits to normal condition. Since the train has entered the siding it is clear that any following train can proceed and so not only the first preceding, but also the second preceding block, should be moved to "green" position. The train on the siding cannot contact section C^2 on the main line opposite the siding to do this. Consequently, a circuit 48, in shunt with the circuit 12 to the section C^2 of the main line, is provided to supply current for section C^5. Whenever section C^5 gets current the second preceding block goes to "green", as though it had been operated by a train on the main line.

Section C^5 is made quite short so that there is only a momentary impulse through the magnets 5 of the preceding blocks, thereby preventing a following train from passing its block and then passing its section C^3 (which pulls the preceding block to "red"), before the train on the siding leaves the section C^5. If this occurred the preceding block might not be pulled to "red" by the following train, as both magnets 4 and 5 thereof would be actuated together and the block would remain where it was, namely, at "green" caused by the train on C^5. The train now moves into the siding along section C^5 and comes to rest on section C^6, which is supplied with current through a branch from the feed conductor in which is a normally open switch 49. Switch 49 may be manually controlled, but preferably is operated automatically as hereinafter described.

When it is desired to start the car and

move it out from the siding J^1, the switch 49 is closed, thereby supplying current from feed wire B to section C^6 of the third rail. The car then moves forward to section C^7. This section of the third rail is supplied with switch controlling current through circuits, as follows: from feed wire B through bridge *b* and contacts 7 of the second preceding semaphore I, thence by way of conductor 50, and through bridge *b* of the next semaphore II, thence to feed wire 51 and through a winding of magnet 28^a, thence to terminal 52 of switch 53, then across bridge 79 to terminal 55, to section C^7, then through the car motor to negative. The circuit includes the bridges *b* of two previous blocks, and consequently if either of the two previous semaphores are turned to the "red" position, no controlling current will be supplied to section C^7, thereby preventing a car on the siding from moving out upon the main line, unless the car ahead is at least two blocks in advance. The windings of magnet 28^a are such that only sufficient current can pass through the circuit described to operate said magnet, but not enough to turn over the motor of the car. The car will not, therefore, advance, even if current flows through the circuit described.

Switch M^1 is the same type of switch and is operated by the same type of means as switch M. It differs therefrom in the following respects. Arm d^1 is provided with a lead wire 56 connected to the feed wire B. This arm coöperates with two contacts 15^a and 15^b but connects with only one of these contacts at a time. Arm e^1 is provided with a lead wire connection 60 which includes the two contacts 34^a, 35^a of the duplex electromagnet L^1. This arm coöperates with two contacts 16^a, 16^b, but only connects with one thereof at a time. Contact 15^a is connected to a wire 100 leading to a relay 4, contact 15^b to a wire 64 running to magnet 27^a, contact 16^b to a wire 61 running to section C^7, and contact 16^a to a wire 101 running to section C^4 of the main line.

The operation of magnet 28^a pulls down its armature arm and establishes a switch controlling motor circuit as follows: The switch being in the position shown in Figs. 1 and 11, current flows from the feed wire *e* to arm d^1, thence to contact 15^a, thence through wire 100 to a special second winding 57 in the magnet 4 of the next preceding block, thence to wire 58 and through a second winding 59 of magnet 28^a, then across bridge f^1, to a contact 30^a, thence through the field winding N^1, then to contact 31^a, to a contact 32^a, across bridge i^1, to a contact 30^a, and through the armature winding O^1 of the motor K^1 to negative. Energization of magnet 4 of the preceding block thereby closes it to "red" position, preventing a following train on the main line from passing the siding. At the same time the operation of magnet 28^a breaks contact 34^a and cuts off the feed to arm e^1 and consequently to section C^4 of the main line. When the motor begins to operate, the movable switch point of switch J^2 is moved to open position and the arms d^1 and e^1 are rotated upon their supporting pillar. Contact 15^a is broken when the track switch is finally opened and some time before this arm e^1 moves on to contact 16^b. The following additional circuit is then established: from feed wire B through the ordinary winding of magnet 4 of the next preceding block, thence to its section C^3, and by way of conductor 60 and contacts 35^a and 34^a, arm e^1, to contact 16^b, and then through wire 61 to section C^7. The car motor consequently receives propulsion current and moves ahead to section C^8, which is also supplied with current from wire 60. Section C^8 also acts as a protecting block in that if the car chances to pass over section C^7 on the run, in which case the controlling current supply to section C^7 may be sufficient to affect the motor, this controlling current will, nevertheless, energize magnet 28^a and break contact 34^a, through which current is supplied to section C^8. The car must therefore come to rest on section C^8 and remain there until the track switch is fully opened and contact 34^a is again made, as described. The car passes out through the switch onto the main line. Here a trip or contact 62 on the right hand side at the rear of the car or train strikes a track contact 63 and completes a reverse circuit through the motor K^1 as follows: from the feed wire B through lead wire 56 to arm d^1, then to contact 15^b, through wire 64 to the point 65, then through one winding of the magnet 27^a to contact 63 and thence to the return rail. Magnet 27^a pulls down its armature and establishes the following additional circuit from the point 65 through the other winding of magnet 27^a, thence across bridge g^1, through the field winding N^1 in the reverse direction from before, then to a contact 30^a across bridge f^1, and through the armature winding O^1 to negative. Since the current traverses the field winding in the opposite direction the motor K^1 is reversed and the switch J^2 closes.

The current for section C^4, which lies just previous to switch J^2, is supplied from conductor 60 by way of contacts 35^a and 34^a, switch arm e^1 and conductor 101, essentially the same circuit as at the previous block. If either one of the magnets 27^a or 28^a is energized one of the contacts 34^a or 35^a is broken, so that whenever the switch J^2 is

being opened or closed there is a dead section of the third rail just in advance of the switch preventing a following car on the main line from running into a car which is emerging, or has emerged, from the siding.

At T is shown a device for automatically controlling the switch 49 to cause a car traveling along the main line to start a car on the siding out upon the main line, and to also prevent a car on the siding from running out onto the main line until the main line is free to receive it. As illustrated in Figs. 7 and 8, this device comprises a base 70 on which are mounted two electro-magnets 71 and 72. Pivotally mounted upon said base is an insulating arm 73 carrying a bridge *m* and the bridge or switch blade 49 at its opposite ends. Bridge *m* coöperates with two mercury cup contacts 74 and 75 completing a circuit between the switch contacts 52 and 55 before referred to. The switch blade 49 controls two cup contacts 76 and 77 in the feed conductor between the main feed wire and section C^9. The windings of electromagnet 72 are in the circuit 12 to the section C^2, of the third rail on the main line at the siding J. Consequently, whenever a car reaches said section current flows through the electromagnet 72, pulls down one end of arm 73 and causes the switch 49 to close its circuit, thereby starting a car from the siding. The other end of the arm is raised, moving bridge *m* out of its contacts, and breaking the switch controlling circuit to the section C^7, so that the car on the siding merely advances to said section and stops there. It, moreover, cannot advance until the preceding car on the main line advances at least two blocks and pulls the two blocks preceding the switch J^2 to "green" position. This is because the circuit from section C^7 through magnet 28^a includes the bridges *b* of the two preceding blocks, and unless those blocks are at "green" position, no current will flow through magnet 28^a and a circuit through motor K^1 will not be established. The windings of the electromagnet 71 are in a circuit 78 from the main feed wire B to the contact 63. Every car in the system is equipped with a contact 62 arranged to strike the contact 63. Therefore, the car on the main line will strike the contact 63 and close the circuit through magnet 71. This pulls down the arm 73 and closes the controlling circuit to section C^7, allowing the car on the siding to operate magnet 28^a and proceed in the usual way. Preferably, a manually operated switch blade 79 is pivoted at the contact 52 so that that part of the circuit through the bridge *m* can be cut out when this protective feature is desired to be omitted.

At the extreme left in Fig. 1 is represented a magnet 28^b of a special duplex electromagnet, like the electromagnet L, for controlling the track switch leading to a siding, the several circuits to the third rail, the adjacent blocks, etc. This magnet 28^b is in a circuit 80 to a contact 81 lying at a special location near the track, and adapted to be contacted by a contact 82 on the car frame. The circuit 80 also includes the bridges *a* of one, two, three or more previous blocks, three being shown. These bridges close the circuit when the several semaphores are at the "red" position. As above described each train or car in passing turns a block to "red" and simultaneously turns the second previous block to "green." Consequently, there will always be two "red" blocks behind every train. In some cases cars or trains will be run at different speeds, for example passenger trains will run faster than freights. Assume that a slow running freight has passed blocks numbered II and III. It has automatically turned block I to "green." Therefore, when its trip 82 strikes contact 81 nothing will happen, as the circuit to magnet 28^b is broken at the third block back. If, however, after the freight passes block III and before it reaches contact 81, a fast passenger passes block I said block will be turned to "red." This has the effect of leaving three red blocks behind the freight. The circuit to contact 81 is consequently complete. When the freight trip 82 strikes contact 81, magnet 28^b is energized and sets in operation the several motor controlling circuits to open the switch and switch the freight train into the siding. As the passenger train passes the siding it closes the switch 49 and causes the freight to resume its journey. This is a convenient arrangement whereby fast or passenger trains can automatically switch slower, or freight trains, out of the way and thereby pass the same.

Fig. 13 shows a diagrammatic view of an arrangement for supplying the car lighting system with current while the engine or motor car is on a dead block, like the blocks C^2, etc. The lighting system 90 normally gets its current through a shunt circuit 91 from the shoe or collector F, said circuit including a contact 93 and the armature 94 of a relay having a high resistance coil 92, in a shunt 95 from said circuit 91 to the car frame or to negative. Whenever the shoe F reaches a dead section of the third rail, such as section C^2, magnet 92 is deënergized and spring 96 pulls the armature 94 over to contact 97. This contact is in a circuit from a special shoe or collector 98, located far enough back on the train or car to be beyond the break between section C^2 and the next preceding section C^1, or the like. Consequently, the car lighting system 90 now re-

ceives current from shoe 98. When C^2 becomes a live section, current again flows through the coil 92, the armature 94 is pulled over and the lighting system gets its current as before.

The apparatus described can be used in a number of different ways. For example, it can be used as a conveyer system for store service or the like. Each siding, such as the siding J^1, can represent a station in the store service system. Assuming the switch 49 to be manually operated, each station, such as station J^1, will be provided with a button 85 of an annunciator system, the indicator board of which will be at some remote point, which may be considered the starting point of the system. If a person at station J^1 desires to give an order he presses button 85, announcing to the operator at the starting point that an order is to be given. The operator then starts out upon the main line an electric motor car having its contact 14 adjusted or set at the proper point to correspond with the track contact 13 at the particular station calling. The car proceeds along its way until contact 13 is reached, when the track switch J is thrown and the car enters the siding. It comes to rest on the dead section of track marked "C^6." The desired order is then placed upon or in the car and the switch 49 closed by hand. This supplies current to track section C^6 and the car begins to move out toward the main line. The switch 49 is held closed until the car passes onto section C^7. The apparatus then described opens the track switch J^2, the car moves out upon the main line, and switch J^2 is then closed. The car then proceeds along the main line in the same direction as before and completes the circuit returning to its original starting point. The order can be filled and the goods can then be placed upon the car. The car can then be sent out to make another trip in the same manner to deliver goods to the station J^1. Any number of stations can be provided along the main line and cars can be automatically switched into the siding at any one of said stations by properly locating the contacts 13 and 14 upon the several cars and at the several sidings.

The invention can also be adapted for display uses for store windows or the like, or for a toy system for amusement or instruction, in which case it will take care of the movements of a large number of cars, stopping them at various sidings and automatically causing them to proceed on their way. It can also be adapted for moving boats electrically over an artificial pond or stream, in which case the several track members and circuits can be submerged beneath the water, and the boats hitched up to the rails by submerged traveling shoes or collectors. The track can also be curved around islands and the like. Also, if desired, it may be used for a combination boat and train system, in which case the boat circuits can be arranged to control the opening and closing of a bridge for the railway over the stream, suitable connections being made between the block system of the railway and the boat circuits so the bridge will not be opened when a train on the railway is dangerously close. All such adaptations and modifications I consider to be fairly within the scope of the claims hereto appended.

What I claim is:—

1. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, and means operated by the propulsion current and controlled by a car for opening said track switch before the car reaches the same and simultaneously opening the circuit to a section of the feed conductor between the car and switch.

2. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, and means operated by the propulsion current and controlled by a car for opening said track switch before the car reaches the same and simultaneously opening the circuit to a section of the feed conductor between the car and switch, and means for closing said circuit when the track switch is fully closed.

3. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, and means operated by the propulsion current and controlled by a car for opening said track switch before the car reaches the same and then closing the track switch after the car has entered the siding, said means also controlling a branch circuit for feeding a conductor section in advance of the switch and arranged to open said circuit whenever the track switch is operated.

4. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, a motor for operating said track switch, and a motor circuit arranged to be closed by a car reaching the conductor section in advance of the switch, and means operated by said motor and controlling the circuit to a section of the feed conductor in advance of the switch.

5. An electric railway system, comprising

a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, a motor for operating said track switch, a motor circuit arranged to be closed by a car approaching the switch, means operated by said motor for opening the circuit to a track section between the car and switch, means operated by said motor for closing said circuit, and means for reversing the motor circuit when the car has passed through the switch and entered the siding.

6. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, a motor for operating said track switch, a motor circuit arranged to be closed by a car reaching the conductor section in advance of the switch, and means arranged when said motor circuit is completed for establishing an additional circuit through said motor direct from the main feed wire.

7. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, a motor for operating said track switch, a motor circuit arranged to be closed by a car reaching the conductor section in advance of the switch, means arranged when said motor circuit is completed for establishing an additional circuit through said motor direct from the main feed wire, and a switch in said additional circuit operated by said motor for opening said circuit when the track switch is fully opened.

8. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor a motor for operating said track switch, a motor circuit arranged to be closed by a car reaching the conductor section in advance of the switch, and means arranged when said motor circuit is completed for establishing an additional circuit through said motor direct from the main feed wire, said means being arranged to simultaneously open the branch feeding circuit to a feed conductor section in advance of the track switch.

9. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, a motor for operating said track switch, a motor circuit arranged to be closed by a car reaching the conductor section in advance of the switch, and a reversing switch controlled by the car and operated when the same has fully entered the siding for reversing the circuit through the motor and closing said track switch.

10. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, a motor for operating said track switch, a motor circuit arranged to be closed by a car reaching the conductor section in advance of the switch, and a reversing switch controlled by the car and operated when the same has fully entered the siding for reversing the circuit through the motor and closing said track switch, said reversing switch being arranged to simultaneously open the branch feeding circuit to a feed conductor section in advance of the track switch.

11. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, means operated by the propulsion current and controlled by a car for opening said track switch before the car reaches the same, a section of the feed conductor at the siding having a normally open circuit, and a switch for closing the feeding circuit to said section.

12. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch therefor, means operated by the propulsion current and controlled by a car for opening said track switch before the car reaches the same, a section of the feed conductor at the siding having a normally open circuit, and a switch in said circuit controlled by a following car traveling on the main line and arranged to close the circuit to said section when the following car has passed the siding on the main line.

13. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, circuit controlling members for said several sections, track rails arranged to complete the circuit and return the current, a sliding, a track switch leading out from the siding to the main line, and means controlled by a car on the siding and operated when the car reaches a section of the siding feed conductor for opening said track switch but arranged to prevent propulsion of the car until the track switch is fully opened.

14. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, circuit controlling members for said several

sections, track rails arranged to complete the circuit and return the current, a siding, a track switch leading out from the siding to the main line, and a circuit controlled by a car on the siding and including bridges in the circuit controlling members of one or more preceding sections and adapted to be closed when the car reaches a section of the siding feed conductor, said circuit being arranged to open the track switch and propel the car out upon the main line.

15. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch leading out from the siding to the main line, and means controlled by a car on the siding and operated when the car reaches a section of the siding feed conductor for opening said track switch but arranged to prevent propulsion of the car until the track switch is fully opened, and means arranged when said track switch is fully opened to establish a separate branch feed circuit to said conductor section for propelling the car.

16. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch leading out from the siding to the main line, and means controlled by a car on the siding and operated when the car reaches a section of the siding feed conductor for opening said track switch but arranged to prevent propulsion of the car until the track switch is fully opened, means arranged when said track switch is fully opened to establish a separate branch feed circuit to said conductor section for propelling the car, and means for closing the track switch when the car has passed out from the siding.

17. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, track rails arranged to complete the circuit and return the current, a siding, a track switch leading out from the siding to the main line, and a circuit controlled by a car on the siding and operated when the car reaches a section of the sliding feed conductor for operating said track switch, said circuit including a switch controlled by the branch feeding circuit of a preceding section of the main line conductor for preventing operation of the track switch when a following car is taking current from the preceding section.

18. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, electromagnets in the branch circuits to the several sections and energized successively as the car proceeds, and switches operated by said electromagnets and in the branch feeding circuits to sections behind the moving car, said switches being arranged to be opened by said electromagnets to cut off the supply of current to a following car.

19. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, electromagnets in the branch circuits to the several sections and energized successively as the car proceeds, a track switch leading to a siding, means for operating said track switch, and a circuit for controlling said operating means and including switches controlled by the electromagnets of a plurality of preceding sections.

20. An electric railway system, comprising a feed conductor divided into sections fed by branches from a main feed wire, electromagnets in the branch circuits to the several sections and energized successively as the car proceeds, a track switch leading to a siding, means for operating said track switch, and a circuit for controlling said operating means and including switches controlled by the electromagnets of a plurality of preceding sections, said circuit being controlled by a car and adapted to be closed thereby to cause the car to be switched into said siding.

In testimony whereof, I have hereunto set my hand.

CHARLES E. BALZER.

Witnesses:
ELBERT L. HYDE,
WM. P. LARKIN.