W. G. ROOME.

RAILWAY BLOCK SYSTEM.

APPLICATION FILED MAR. 3, 1902.

1,032,345.

Patented July 9, 1912.

3 SHEETS—SHEET 1.

Fig. 2

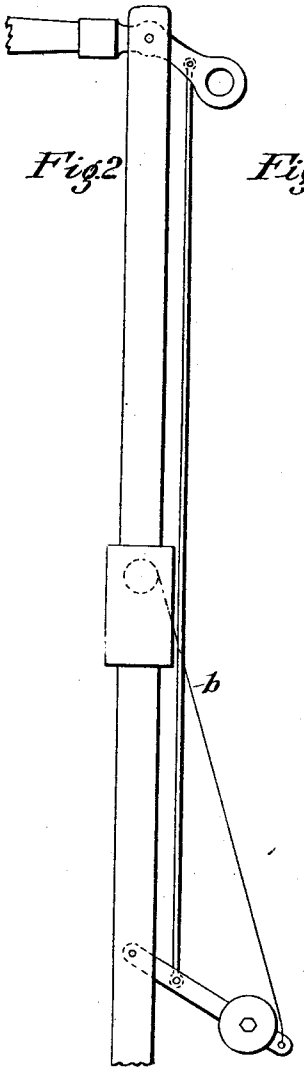


Fig. 1

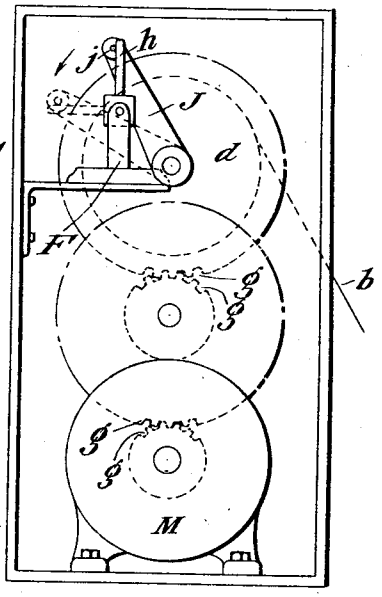


Fig. 9

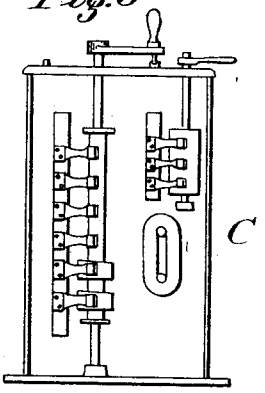


Fig. 5

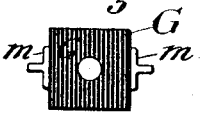


Fig. 3

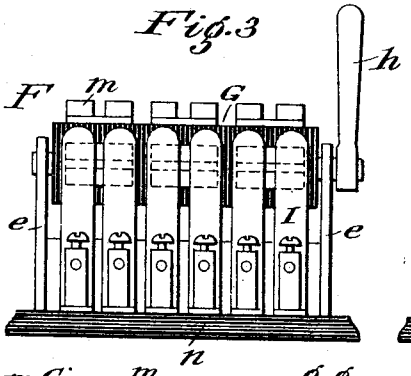


Fig. 4

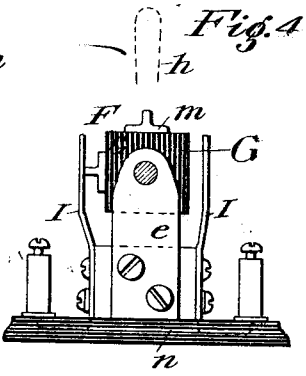


Fig. 8

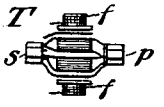


Fig. 7

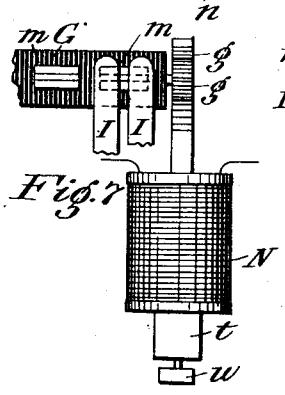
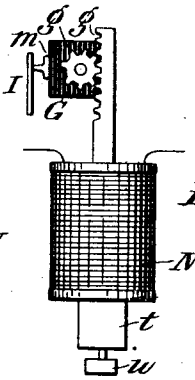


Fig. 6



Witnesses

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3 SHEETS—SHEET 2.

Fig. 11,

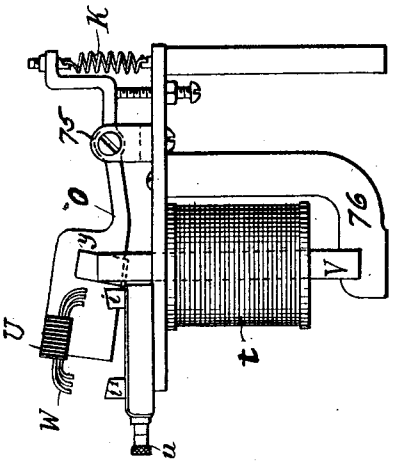


Fig. 10,

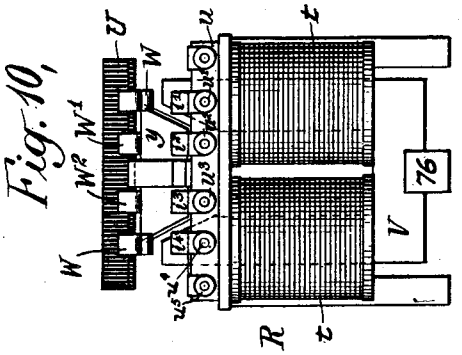
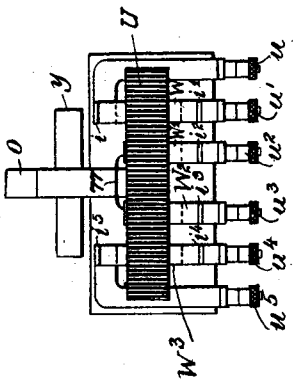


Fig. 12,



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3 SHEETS—SHEET 3.

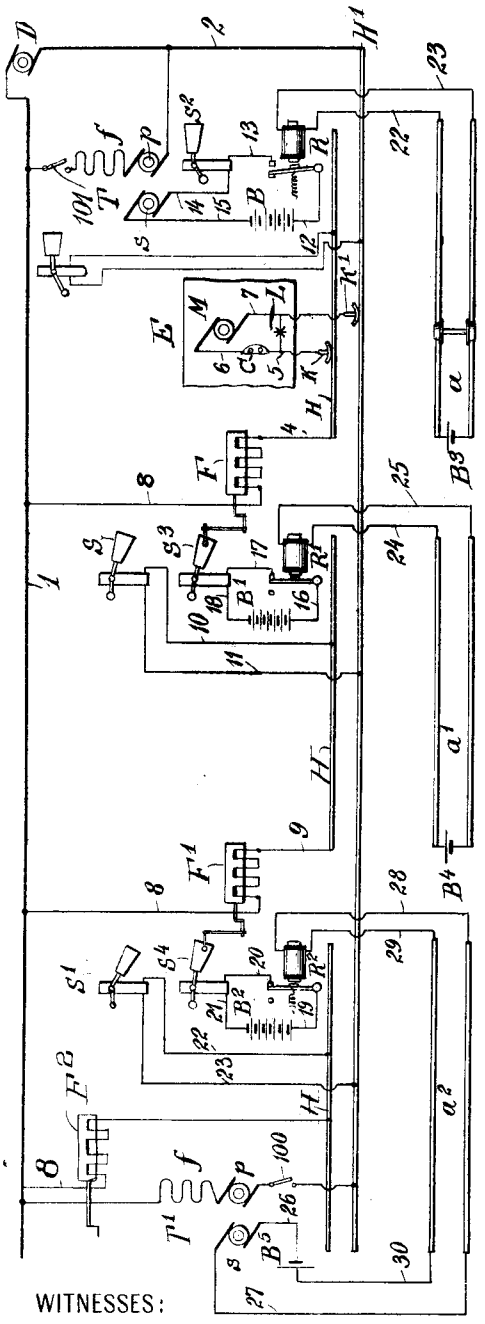

Fig. 13.

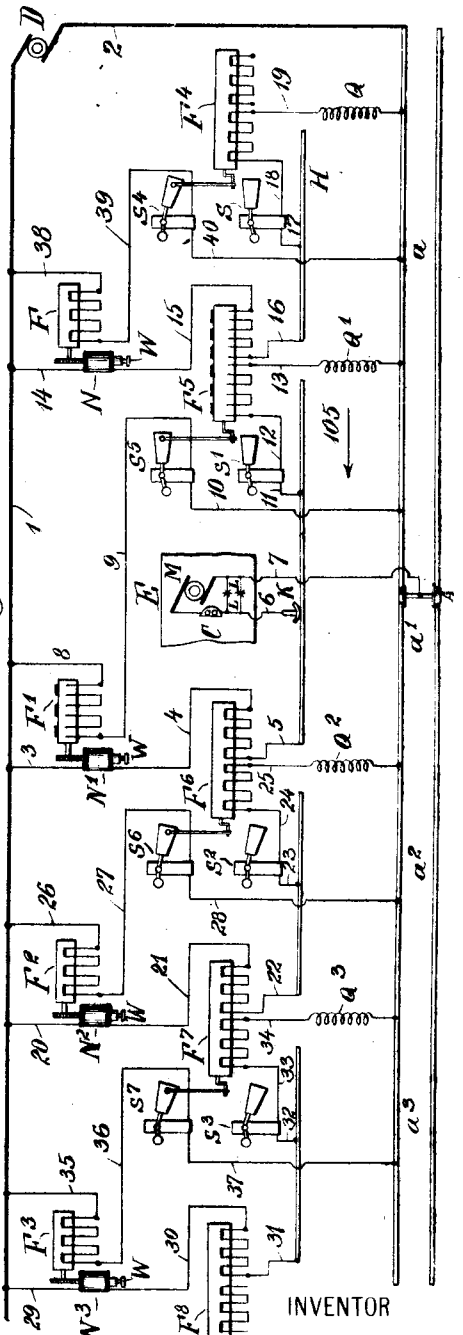

Fig. 14.

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UNITED STATES PATENT OFFICE.

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RAILWAY BLOCK SYSTEM.

1,032,345. Specification of Letters Patent. Patented July 9, 1912.

Application filed March 3, 1902. Serial No. 96,536.

To all whom it may concern:

Be it known that I, WILLIAM G. ROOME, a citizen of the United States, formerly a resident of Jersey City, New Jersey, but now a resident of Los Angeles, California, have invented certain new and useful Improvements in Railway Block Systems, of which the following is a specification.

I will describe several block systems embodying my invention, as well as several parts or pieces of apparatus adapted to be used in these systems, and will then point out the novel features thereof in claims.

In the accompanying drawings, Figures 1 and 2 are views showing the mechanical parts of a signal operating mechanism. Figs. 3, 4 and 5 are views showing a mechanically actuated rotary switch which may be used in connection with my invention. Figs. 6 and 7 are views showing a similar rotary switch but of an electromagnetically actuated type. Fig. 8 is a diagrammatic view showing a motor generator or rotary transformer which may be used in connection with my invention. Fig. 9 is a view showing in section a form of controller such as is ordinarily used on cars of electric railways. Figs. 10, 11 and 12 are views showing a relay device which may be used in connection with my invention. Figs. 13 and 14 are views illustrating diagrammatically portions of a railway having applied thereto two forms of block system embodying my invention.

Similar reference characters designate similar parts throughout the several views.

Referring now to Fig. 1, I have here shown in front elevation a signal operating mechanism embodying my invention. This mechanism may be mounted upon a signal pole and connected with a signal as illustrated in Fig. 2. In Fig. 1, M designates an electric motor which is operatively connected by means of gearing in a usual manner with a drum *d*. I have shown two gear wheels with portions of the gear teeth *g*. The upper gear wheel is secured to the drum *d*. Wound upon the drum *d* is a wire rope or chain *b* for moving the semaphore on its pivot in a manner such as is shown in Fig. 2. To this upper gear wheel is also secured an arm or stud J carrying a pin *j* which latter is arranged to engage with and move a handle *h* of a rotary switch F hereinafter described. The pin *j* is in loose engagement with the handle *h*. The solid lines indicate the positions which the arm J and the handle *h* assume when the semaphore is in danger position, and the arrow indicates the direction in which these parts and the drum *d* rotate when the signal is moved to safety position. During this movement, the drum makes a little more than one complete revolution, the arm and handle then assuming the positions indicated by the dash lines. On completing one revolution, the pin *j* strikes the handle *h* on the side opposite to that shown in the solid lines, and during the remainder of the rotation the pin rotates the handle *h* of the rotary switch F. When the motor is deënergized, and the counterweight returns the signal to the danger position, the gear wheel *d* and pin *j* are rotated in the reverse direction to that indicated by the arrow. The pin *j* makes a little more than one complete revolution in this reverse direction, striking the handle *h* on the other side and returning this handle with the rotary switch F to the position shown in the solid lines. I do not desire to limit myself to this particular method of operating the rotary switch F by the movement of the signal mechanism, as any method may be used by which the switch shall be shifted just as the signal semaphore is completing its movement to one position or another.

Figs. 3 and 4 are side and end views respectively of a form of rotary switch which may be used in connection with my invention. This switch comprises a base *n* of insulating material upon which are mounted two upright supports *e*, *e*. These supports act as bearings in which revolves a block G of insulating material to which is secured the operating handle *h*. Secured also to the block G are small metal bridging contact pieces *m* which are arranged to be engaged and disengaged, by the rotation of the block G, with upright contact springs I, which are mounted upon the base *n*. When these contact pieces *m* are mounted on the block G in the arrangement shown in Fig. 4, the shifting of the block G through a quarter-revolution acts to disconnect one set of contact pieces from the springs on one side, and to connect another set with the springs on the other side. The contact pieces *m*

may however be arranged on the block G as illustrated in Fig. 5, in which case a quarter-revolution of the block G will act to disconnect the contact pieces from the springs on each side at the same time. This rotary switch is adapted to make a quick break, and it may be used to open a circuit in several places at the same instant. As the block G is revolved, it is evident that a rubbing contact is made between the contact pieces *m* and the springs I. The block G is of square construction, and it may be so proportioned that at the moment a contact piece *m* leaves a contact spring I, the corner of the block G strikes the spring I and forces it away from the contact piece *m*. This arrangement effects a break in a circuit twice as quickly as an ordinary switch, since the spring I and the contact piece *m* are each moving away from the other at the time the break occurs. Although I have in Fig. 3 shown six contact springs I on each side of the switch, it is to be understood that this number of springs may be varied to suit the conditions under which the switch is to be used.

In Figs. 6 and 7 I show a method by which a rotary switch such as I have just described may be operated by means of a solenoid N. Instead of the handle *h*, a small gear wheel is in this case secured to the shaft of the block G, and the teeth of this gear wheel mesh with the teeth of a rack carried by a plunger *t* of the solenoid N. This plunger *t* may be held in its lower or deënergized position by means of a weight *w* secured to its lower end. When the solenoid is energized, the plunger *t* will be raised, shifting the block G and opening the contact between the contact pieces *m* and the contact springs I.

In Fig. 8 I have shown diagrammatically a motor generator or rotary transformer T, such as may be used in connection with my invention for the purpose of charging storage batteries as hereinafter explained. A motor generator of this type is shown and described in Letters Patent No. 683621, granted to me on October 1, 1901. The commutator on one side is connected with a primary coil *p*, and the commutator on the other side is connected with a secondary coil *s*.

Fig. 9 is a view showing a controller C, such as is used on the cars of an electric railway. I here show a view of such controller in order that for the sake of brevity and clearness I may refer to it hereafter by the reference character C.

Referring now to Figs. 10, 11, and 12, I have here shown respectively a front elevation, side elevation, and a partial plan view of a relay which may be used in connection with my invention. This relay is adapted to control a plurality of circuits by the movement of its armature, and is particularly adapted to be used in an alternating current circuit. V designates a core, upon which are wound coils *t*. This core is preferably comprised of laminated soft iron stampings, and is substantially U-shaped as shown in Fig. 10 to bring its two poles adjacent one another. O designates an armature pivoted at 75 to a frame 76 which supports the core V; to this armature is secured an armature piece *y*, also comprised of laminated soft iron stampings and so arranged that when attracted by the poles of the core V it will form a complete magnetic circuit with the core. By means of this arrangement the coils *t*, *t* act as a choke coil when energized by alternating current and when the armature is closed. An economical relay is thus produced; the farther the armature piece *y* is drawn away from the poles of the core, the less the choking effect becomes upon the alternating current in the coils, and consequently the stronger the pull exerted by the core upon the armature; but when the armature is closed and only a small amount of current is required to hold it closed, the choking effect is greatest and the current consumption is therefore reduced to a minimum. By the use of a laminated core, I provide a relay which will hold strongly when energized by alternating current, and whose armature vibrates only slightly due to the alternations of the current. A spiral spring *k* serves to hold the armature open when the coils are deënergized. Secured to the armature O is a block U of insulating material in which are mounted contact springs W, W′, etc. These springs are composed of a number of thin strips laid together to provide flexibility and to permit of good electrical connections when there is a slight vibration of the armature due to the use of alternating current in the coils. When the armature is closed, spring W makes electrical contact with two contact blocks *i* and *i′*, which contact blocks are electrically connected with binding posts *u* and *u′* respectively. The surfaces of these contact blocks are slanted so that when they are engaged by contact spring W, a rubbing contact will be made. Contact spring W^3 is adapted to make contact with two similar contact blocks i^4 and i^5, which latter are likewise connected with binding posts u^4 and u^5. W′ and W^2 are each a half contact spring making contact respectively with two blocks i^2 and i^3. These two contact springs are shown as being connected electrically by means of a wire 77, but obviously the wire may be dispensed with by forming the springs of one piece bent into the proper shape. Contact blocks i^2 and i^3 are electrically connected respectively with binding posts u^2 and u^3.

One feature of my invention is the provision, in a railway block system, of a safety

or intermediate block section behind a car. This safety block section is automatically kept guarded behind a car, no car being permitted to enter it even though the safety block section itself may not be occupied by a car and may not be deranged. I provide this safety block section by means of a novel control of the signal circuits and of the circuits for the current used for the propulsion of the cars along the railway. That is, I so arrange this safety block section that if it is entered upon by a car, passing a danger signal at the entrance of the safety block, the propulsion current will be cut off from the car. I also provide for this safety block section a signal, preferably a semaphore or other visual signaling device, which shall denote to the motorman of an approaching car, whether or not the propulsion current circuit for the block section is open or closed; that is, whether or not the propulsion current will be cut off from the car when it shall enter the block section.

Referring to Fig. 13, I have here shown an application of my safety or intermediate block section to a railway system in which electricity is used as the propulsion power for the cars or trains. D designates a generator which furnishes current for propelling the cars. H′ is a continuous feed rail, and H is a sectional feed rail divided into block sections corresponding with block sections a, a', etc., of the rails of the railway. The continuous feed rail H′ is shown as being connected directly with one terminal of the generator D by a wire 2, and the sections of the divided rail H are shown as being connected with the other terminal of the generator through rotary switches F, F′, etc. These rotary switches may be of a type such as I have shown in Figs. 3, 4 and 5 of the accompanying drawings and described hereinbefore. Each block section a, a' etc., of the track rails of the railway is provided with a track battery B^2, B^4, etc. and with a relay R, R′, etc. These relays may be of a type such as I have shown in Figs. 10, 11 and 12 of the accompanying drawings. Each of these relays controls a circuit in which is included a motor device S^2, S^3, etc., which is used for operating the rotary switch F, F′, etc. of the preceding block section. These motor devices may be signal operating mechanisms of a type such as I have shown in Fig. 1 of the accompanying drawings, or they may be solenoid operated mechanisms of a type such as I have shown in Figs. 6 and 7. In the case of a signal operating mechanism being used, the semaphore blade may be omitted, or it may be employed, as shown in Fig. 2, in which case it forms an additional visual signal. The circuit for the motor device S^2 may be traced as follows—from battery B′ through wire 18, motor device S^2, wire 17, armature of relay R′, wire 16 to battery B′. The circuits for motor devices S^2 and S^4 may be traced in similar manners. For each block section I provide a signal S, S′, etc., and in this view I show these signals as being controlled directly by the car propulsion current from the generator D. The circuit for signal S is as follows: from generator D through wires 1 and 8, switch F, wire 9, sectional feed rail H, wire 10, signal S, wire 11, continuous feed rail H′, wire 2 to generator D. The signal S′ is shown as connected with the feed rails H and H′ of block section a^2 by wires 22 and 23. These signals S, S′ etc., may be of the type shown in Figs. 1 and 2 of the accompanying drawings and described hereinbefore. E designates a car or train carrying shoes or brushes K and K′ which make sliding contact with the feed rails H and H′ respectively. M is a motor for moving the car or train, and C is a controller which may be of a type such as I have shown in Fig. 9 of the accompanying drawings. The circuit for the propulsion current for car E may be traced as follows: from generator D through wires 1 and 8, contacts of rotary switch F, wire 4, feed rail H, shoe K, wire 5, controller C, wire 6, motor M, wire 7, shoe K′, feed rail H′, wire 2 to generator D. A signal lamp L carried by the car E is connected between wires 5 and 7 so that it is always in circuit with the feed rails H and H′ irrespective of the control of the motor circuit by the controller C. The switches F, F′, etc., are so connected with the motor devices S^2, S^4, etc., respectively that when these motor devices are in the "clear" position,—that is, when the block sections by which they are controlled are unoccupied, by cars or trains the contacts of the switches will be closed and the propulsion circuit therefore closed to the sectional feed rail H of the preceding block section.

The operation of this system may now be described as follows: As indicated in the drawing, the block sections a' and a^2 are clear, hence signals S and S^3 are in their clear positions and the car E may enter block section a'. Should there be a car or train on block section a^2, the shunting of the relay R^2 would open the circuit for the motor device S^4 which would operate rotary switch F′ to open its contacts. The opening of switch F′ would cut off current from the sectional feed rail H of block section a' and this would move signal S to its danger position. The fact that signal S is in danger position would then denote to the motorman of a car E in block section a that the sectional rail H of block section a' is disconnected from the source of propulsion current. Should the car E now move past signal S and into block section a' its oper-

ating power would be cut off and its signal lamp L extinguished. If this block section a' should be on a downward grade and the car be running by gravity, it would still have to pass the danger signal S′ (and the danger signal S^4 if used as a signal) before reaching the car or train in block section a^2.

The batteries used in this system may be storage batteries, and charging circuits and apparatus for these batteries may be provided as indicated in the drawing. For example, the track batteries may be charged by the use of rotary transformers as indicated at T′ for track battery B^5, the primary winding p and field f of this transformer being connected across the propulsion current, circuit from wire 1 to the feed rail H′. A switch 100 may be included in this primary circuit to control the operation of the rotary transformer. A similar transformer T may be used as indicated for charging the batteries used for the operation of the motor devices S^2, S^3 etc. with a switch 101 for controlling the supply of power to this transformer. These rotary transformers may be of a type such as is shown in Fig. 8 of the accompanying drawings.

Fig. 14 shows an application of a signaling system embodying my safety or intermediate block section to an ordinary electric railway using a trolley or a third rail. H is a trolley or third rail which is divided to form block sections a, a', a^2, etc., the track rails being continuous. It is understood that cars are moving in the direction indicated by arrow 105. D designates a generator from one terminal of which extends a main feed wire 1. The other terminal of the generator D is connected with the track in the usual manner by a wire 2. The main feed wire 1 is connected with the third rail H of each block section through the windings of solenoids N, N′, etc., and through contacts of rotary switches F^5, F^6, etc. For example, the connection between the main feed wire 1 and the third rail H of block section a is—through wire 14, winding of solenoid N, wire 15, contacts of rotary switch F^5, wire 16 to third rail H. The third rail of each block section is connected with the main feed wire 1 in a similar manner. Each of the solenoids N, N′, N^2 and N^3 is used to operate a rotary switch F, F′, F^2 and F^3 in the manner shown in Figs. 6 and 7 of the accompanying drawings, and each of these rotary switches controls the circuit of a signal S^4, S^5, S^6 and S^7. The circuit for signal S^4 is—from generator D through main feed wire 1, wire 38, contacts of rotary switch F, wire 39, signal S^4, wire 40, rails of the trackway, wire 2 to generator D. The circuits for each of the signals S^5, S^6 and S^7 may be traced in a similar manner. These signals S^4, S^5, S^6 and S^7 are used to operate respectively rotary switches F^4, F^5, F^6 and F^7 as illustrated in Fig. 1 of the accompanying drawings. The semaphores of these signals are unnecessary, but they may, however, be used if desired, as signals to indicate the exact position of a car ahead. These signal mechanisms may be equally well displaced by solenoids for the operation of the rotary switches as illustrated in Figs. 6 and 7 of the accompanying drawings. At the rear or entrance end of each block section I place a signal, as S, S′, S^2 and S^3, each of which is normally in a closed circuit between the main feed wire 1 and the track rails through the third rail H, contacts of two of the rotary switches as F^4, F^5, F^6, F^7, etc., and a resistance as Q, Q′, etc. For example, the circuit for signal S may be traced as follows: from generator D through main feed wire 1, wire 14, solenoid N, wire 15, contacts of rotary switch F^5, wire 16, third rail H of block section a, wire 17, signal S, wire 18, contacts of rotary switch F^4, resistance Q, rails of the trackway, wire 2 to generator D. The circuit for each of the signals S′, S^2 and S^3 may be traced in a similar manner. The resistance Q, Q′, etc., may be dispensed with if desired by so winding the coils of the motors or solenoids used to operate these last mentioned signals as to include the equivalent of the resistances Q, Q′, etc., in the windings. Each of the rotary switches F^4, F^5, F^6 and F^7 is adapted to control two circuits—the main feed circuit connection to the third rail or trolley H of the block section in the rear, and the circuit for the signal for its own block section. Thus rotary switch F^6 controls the main feed circuit to the third rail of block section a', and also the circuit for signal S^2 of block section a^2. Each of these rotary switches is closed when the signal which operates it is in the clear position and each of the rotary switches F, F′, F^2 and F^3 is closed when the solenoids N, N′ N^2 or N^3 are deënergized. Each of the signals S, S′, S^2 and S^3 denotes the condition of two block sections in advance. For example, signal S denotes the condition of block sections a and a'. There being a car E shown in block section a', signal S is at danger position, and the block section a is the safety or intermediate block section protecting the rear of car E. Although there is no car in block section a, the interlocking of the circuits holds signal S in danger position while the car E remains in block section a' in advance. Signal S′ is also at danger, making a second danger signal which must be passed before reaching the car E. Signal S^2 being in safety position indicates that there is no car in either block section a^2 or a^3; and signal S^3 being in safety position similarly indicates that there is no car in block section a^3 or in the next succeeding block section in advance

(not shown). The cores of solenoids N, N′, N^2 and N^3 are each provided with a weight W so adjusted that when the current for these solenoids passes through respectively the resistances Q, Q′, Q^2 and Q^3, it will not be of sufficient strength to lift the cores, and the rotary switches will therefore be normally closed. When however, one of these resistances is shunted, by the motors and signal lamps of a train in the block section, the current through the solenoid becomes of sufficient strength to operate the core and open the rotary switch.

The operation of this system may now be explained as follows: When a car E enters a block section, for example block section a' the current passing through two signal lamps L, L, on the car in addition to that passing through the resistance Q′ is sufficient to cause the core of the solenoid N′ to be lifted, thus opening rotary switch F′. The path of the current through the car is from generator D through main feed wire 1, wire 3, solenoid N′, wire 4, rotary switch F^6, wire 5, third rail or trolley H, shoe K, wire 6, controller C, motor M (also through lamps L, L in multiple with the controller and motor) wire 7, axle and wheels A, rails of trackway, wire 2, to generator D. The opening of the contacts of rotary switch F′ opens the circuit for signal S^5, which latter moves to danger position and in doing so, opens the contacts of rotary switch F^5. The opening of rotary switch F^5 breaks the circuit for signal S′, which therefore moves to its danger position. I may add that it is not necessary to depend upon the breaking of the circuit for signal S′ by rotary switch F^5 to move the signal to danger position, since the circuit for this signal may be so adjusted, if desired, that the circuit through the motor and lamps of car E will shunt sufficient current from the signal to cause the signal to move to danger position. The opening of the circuit by the rotary switch holds this signal in the danger position, however, as long as block section a' is occupied.

The foregoing remarks regarding adjustment of the circuit for signal S′ apply equally well to the circuits for signals S, S^3 and S^3. The opening of the contacts of rotary switch F^5 also opens the feed circuit from the main feed wire 1 to the third rail or trolley H of block section a in the rear of the block section occupied by the car E. The opening of this feed circuit opens the circuit for signal S of block section a, which signal therefore moves to danger position. The fact that signal S is in danger position indicates to the motorman of a car approaching block section a that the sectional feed rail H of that block section is disconnected from the source of propulsion current, and that therefore if the car should enter that block section its propulsion current would be cut off.

It will be noted that in the railway signaling systems I have just described, the signal lamps L on a car or train denote, if burning, that the block section ahead is clear; but if extinguished they denote that the block section ahead is occupied. If, for example, with a car in block a' another car were to pass the danger signal of the block section in the rear and enter the safety or intermediate block a, its signal lamp would be extinguished and its operating power shut off. The motorman of the car in block a would become aware of car E passing out of block a' by the lighting of his signal lamp and he could then proceed in safety to the signal governing block a'.

The signaling systems which I have just described are of the type known as "normal safety" systems. That is, when the blocks are unoccupied by cars and the circuits are in proper working condition, all signals will be held in the safety position.

Having thus described my invention, what I claim is:—

1. In a railway signaling system the combination of a plurality of block sections, a track circuit for each block section comprising a source of current and a relay, a signal for each block section, a local circuit for each of said signals controlled by the relay of the corresponding track circuit, a generator, feeding and return conductors extending therefrom, a supply conductor extending along the railway and divided into sections corresponding to the block sections, a circuit controller between each section of the supply conductor and the feeding conductor and operated by the signal for the block section in advance.

2. In a railway signaling system the combination of a plurality of block sections, a track circuit for each block section comprising a source of current and a relay, a signal for each block section, a local circuit for each of said signals controlled by the relay of the corresponding track circuit, a generator, feeding and return conductors extending therefrom, a supply conductor extending along the railway and divided into sections corresponding to the block sections, a circuit controller between each section of the supply conductor and the feeding conductor and operated by the signal for the block section in advance, and a second signal for each block section having as a part of its controlling circuit the section of the supply conductor for the corresponding block section.

3. In a railway signaling system, the combination of a plurality of block sections, a track circuit for each block section comprising a source of current and a relay, a signal for each block section, a local circuit for

each signal controlled by the relay of the corresponding track circuit, a source of propulsion current, a third rail or trolley extending along the railway and divided into sections corresponding to the block sections, and a circuit controller between the source of propulsion current and each section of the third rail or trolley and operated by the signal for the block section next in advance.

4. In a railway signaling system, the combination of a plurality of block sections, a track circuit for each block section comprising a source of current and a relay, a signal for each block section, a local circuit for each signal controlled by the relay of the corresponding track circuit, a source of propulsion current, feeding and return conductors extending therefrom along the railway, a third rail or trolley extending along the railway and divided into sections corresponding to the block sections, a circuit controller between the feeding conductor and each section of the third rail or trolley and operated by the signal for the next block section in advance, and a signal device for each block section connected between the section of the third rail or trolley for that block section and the said return conductor for the propulsion current.

5. In a railway signaling system, a plurality of block sections, home and distant signals for the block sections, a track circuit for each block section each for the control of the home signal for the corresponding block section, a source of propulsion current, a third rail or trolley extending along the railway and divided into insulated sections corresponding to the block sections, a circuit controller between the source of propulsion current and each section of the third rail or trolley and controlled by the track circuit of the next succeeding block section, and a circuit for the control of each distant signal including the section of the third rail or trolley for the block section preceding the block section whose condition is indicated by such distant signal.

Signed at Jersey City in the county of Hudson and State of New Jersey this first day of March A. D. 1902.

WILLIAM G. ROOME.

Witnesses:
D. G. GRANT,
A. C. GREENE.