No. 898,219. PATENTED SEPT. 8, 1908.

J. HUTCHINSON.

RAILWAY ELECTRIC SIGNALING.

APPLICATION FILED MAY 10, 1905. RENEWED JAN. 4, 1907.

2 SHEETS—SHEET 1.

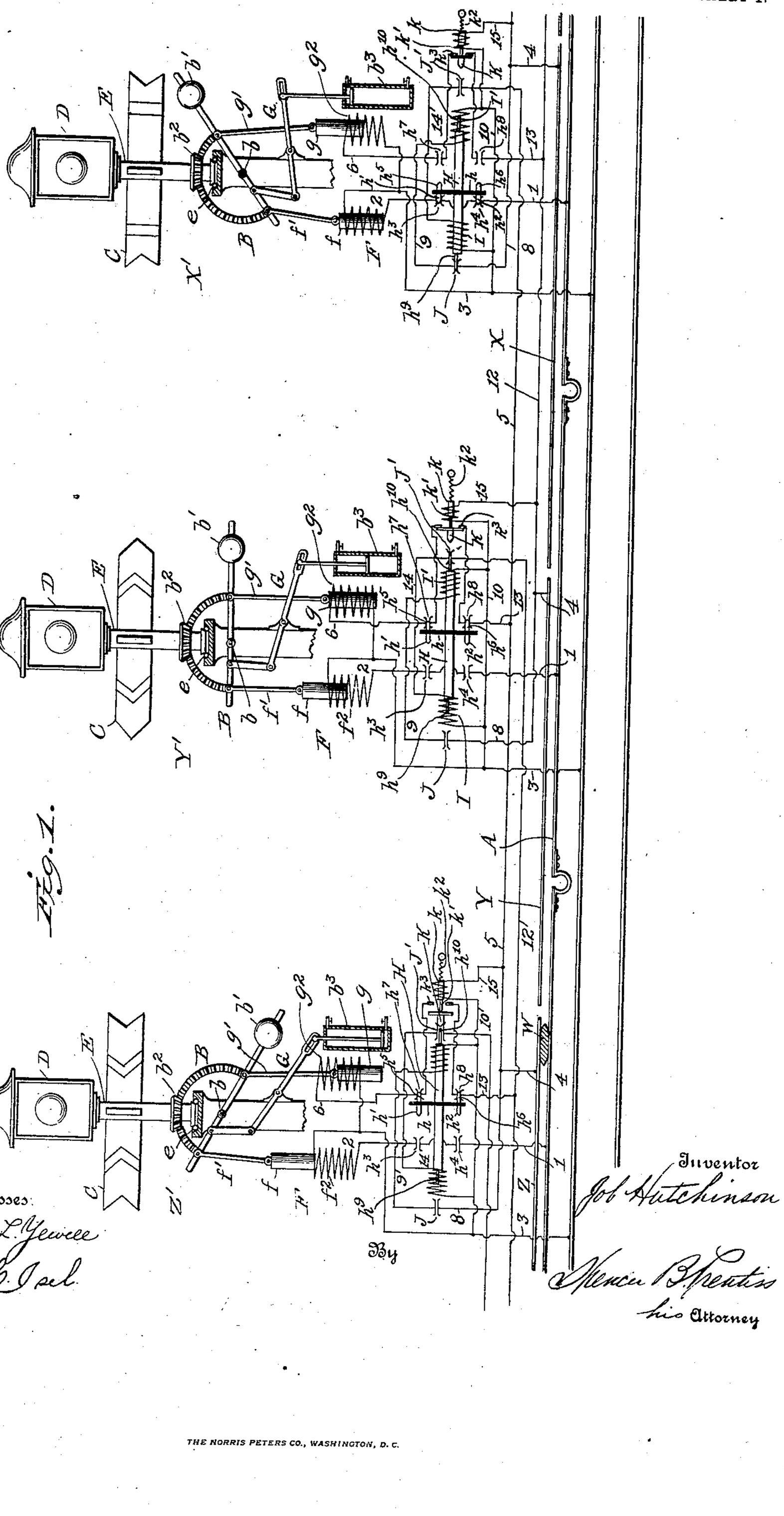

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

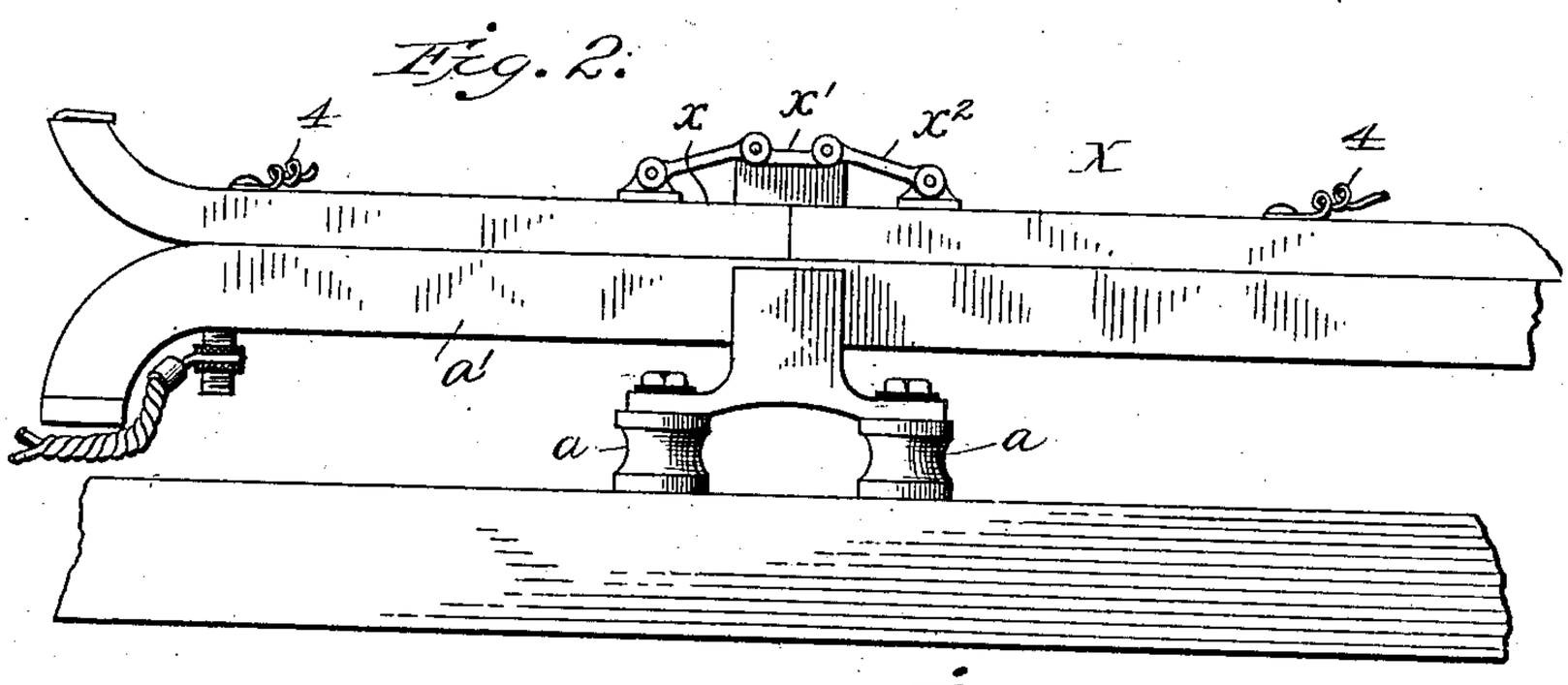


Fig. 3.

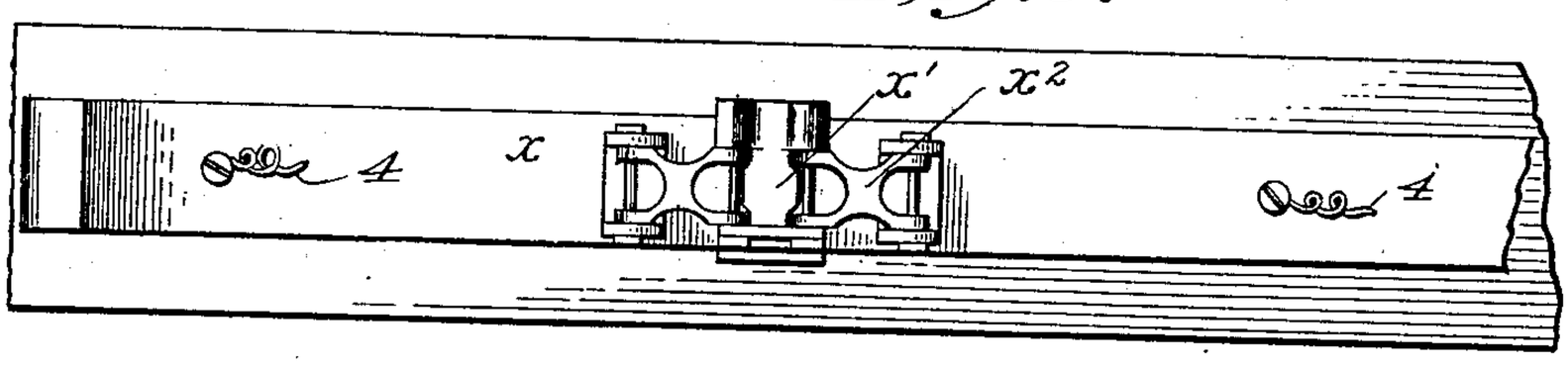
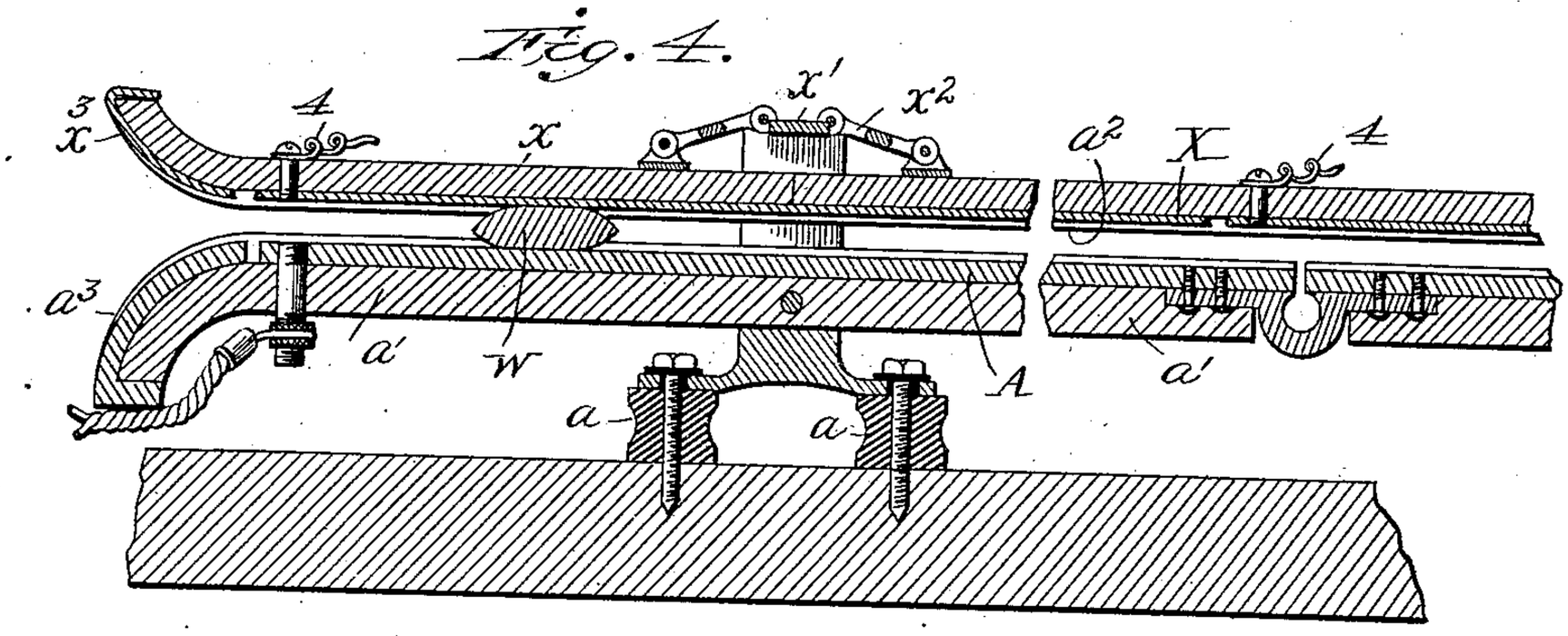


Fig. 4.



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RAILWAY ELECTRIC SIGNALING.

No. 898,219. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed May 10, 1905, Serial No. 259,813. Renewed January 4, 1907. Serial No. 409,365.

To all whom it may concern:

Be it known that I, JOB HUTCHINSON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Railway Electric Signaling, of which the following is a specification.

My invention relates to railway electric signaling, wherein a car or train moving along a railway track shall control the movement of signals along the line of the track to notify the engineer or motorman of other trains or cars that it is either safe or unsafe to proceed.

More specifically stated my invention relates to electric block signaling systems in which the railway is divided into blocks or sections each of which is provided with signaling means which are controlled by the movement of trains or cars upon the track as they enter and leave the various blocks or sections, suitable circuit connections being made from one block or section to another so that the control may extend to one or more blocks adjacent or near the block occupied by the moving car or train.

The invention has for its principal object the production of a railway electric block signaling system and apparatus therefor, of the general type above indicated, which is particularly designed for use in connection with electric railways in which current is supplied to the motors of the cars by a conductor extending along the line of the road, but in its broad aspect both the system and apparatus or various parts and modifications thereof may be used with railways of other types.

In the embodiment of my invention hereinafter described, and which I illustrate in the accompanying drawings, I show an electric railway of the third rail type in which the rail is mounted along the side of the track and adapted to be engaged by a collector or contact-shoe carried by the car. In addition to the third rail, which carries the current for operating the car motors, I provide a sectional conductor which is preferably arranged in close proximity to the third rail and to which current is supplied from the third rail by a contact carried by the car, preferably the main collector or shoe of the car itself. The sectional conductor therefore constitutes a signal rail, the sections being made any length which it is desired to have the blocks between the signal stations, and each section or block is provided with signaling apparatus which will respond to the current supplied from the third rail when a car is in the block.

An important feature of my invention is the construction of the signal rail above referred to, this being combined with the railway third rail of my special construction or may be adapted for application to third rails already installed and now in general use.

In explaining my invention I shall first describe the signaling system in its preferred embodiment, and then describe one form of combination third rail and signal rail construction adapted for use with the system.

My invention is illustrated in the accompanying drawings, in which

Figure 1 is a diagrammatic representation of three stations and sections of my system. Figs. 2, 3, and 4, are views showing a preferred form of contact rail for use with the system.

Referring to the drawings, and more particularly to Fig. 1 thereof, A represents the third-rail, extending along the line of the railway and which supplies electric energy to the car motors in the usual manner. Adjacent the third rail A is the signal rail of which three sections or blocks X, Y, and Z, are shown. The car or train is supposed to be moving from right to left upon the track, and at the entrance of each block or section X, Y and Z, is arranged a signal post X^1 Y^1 and Z^1, equipped with any suitable type of both day and night signals, and operating mechanism therefor, having suitable electrical connections with the sectional conductors and the third rail, as will be fully hereinafter explained. The apparatus and circuit connections of these signal posts or stations is preferably identical, so that the description of one will serve as a description of all, and consists of an operating mechanism for the signals and a controlling mechanism which governs the supply of current to said operating mechanism.

The operating mechanism consists of a lever B pivoted at *b* to the post or a stationary part of the frame and carrying on one arm a weight b^1 which tends to maintain the lever normally in one position. Lever B is connected by any suitable means such as beveled gears b^2 with the signal, which in the form shown are arms C for the day signal and lantern D for the night signal mounted upon the top E of the post. This portion E of the

post is mounted in a vertical position to rotate on ball-bearings *e*, so that a minimum amount of power is required to turn the signal.

In order to operate the signal, I have shown electromagnetic motive devices F and G, which preferably consists of solenoid magnets. The core *f* of motive device F is connected by a rod f^1 with one arm of lever B, and the core *g* of motive device G is connected by a rod g^1 with the other arm of lever B. The lever B is connected by lever mechanism as shown, or in any suitable manner with a dash-pot b^3 or its equivalent to retard the movement of the signal. The coils of the magnetic motive devices F and G are lettered respectively f^2 and g^2.

The signal circuit controlling device, in its embodiment illustrated, consists of a solenoid-operated contact controller having a core H coöperating with two solenoids I I^1. Core H is mounted to reciprocate when acted upon successively by the solenoids, and carries between them two sets of contacts mounted upon but insulated from a cross piece *h*. Two of these contacts h^1 h^2 are adapted to bridge respectively two sets of contact springs h^3 h^4 which are included in the circuit of solenoid f^2. When the contact springs just mentioned are engaged by the contacts h^1 h^2 therefor, the circuit through solenoids f^2 is completed, as will be hereinafter more fully explained. Cross-piece *h* also carries another set of contacts h^5 h^6 similarly arranged to bridge respectively contact springs h^7 h^8 which are included in the circuit of solenoid of g^2.

Included in the circuit of solenoid I^1 is a pair of contact springs J normally separated from each other and mounted in alinement with core H in such a manner as to be engaged and bridged by a contact h^9, when said core is in one of its extreme positions. A similar pair of contact springs J^1 are mounted upon or adjacent solenoid I^1 and are separated from each other and included in the circuit of solenoid I. These contact springs are also in alinement with core H and adapted to be bridged by contact h^{10} carried by the core when it is in its other extreme position. These contacts are preferably of the knife-edge type, so that core H is held by the slight pressure in either position until again moved by an electric impulse. Coöperating with this pair of contacts J^1 is a disabling device consisting of a plunger K of insulating material carried by the core *k* of a solenoid k^1 and adapted when said solenoid is energized to further separate the contact springs J^1 to such a degree that they cannot be bridged or engaged by contact h^{10} carried by the core H. A spring k^2 is provided to hold plunger K normally in a contracted position. Disabling device K also controls contacts k^3 to open the circuit of solenoid g^2.

The solenoid f^2 is supplied with current from the third rail or supply conductor A through conductor 1, contacts h^4 h^3 when bridged by contacts h^2 h^1, conductor 2, conductor 3, and returned by the track or ground. Solenoid g^2 is supplied with current from the station next in advance of its own through the car contact W when the car reaches that section, conductors 4 and 5 (between stations Y^1 and Z^1, and conductors 4 and 12 between stations X^1 and Y^1), contacts h^8 h^7 when bridged by contacts h^6 h^5, contacts k^3, conductor 6, conductor 3, and returned by ground as before. The remainder of the circuit connections both at the individual stations and between stations will now be described in connection with the operation of the system.

Normally when there is no car or train upon any of the sections the apparatus and circuit connections are in the position shown at station X^1 of Fig. 1, the signal at this station indicating clear. In this position it is held by the operation of solenoid f^2 which is energized from the main conductor A through conductor 1, contacts h^2 h^4 h^1 h^3, and conductors 2 and 3. The car is supposed to be moving from right to left in said figure and when it enters the block of section X of the sectional conductor, current is supplied from the main conductor, through the car contact W, section X, conductor 4, conductor 8, contacts J and h^9, conductor 9, solenoid I^1, conductor 10, and return to ground by conductor 3. This energizes solenoid I^1 which attracts the core H, thereby opening its own circuit at contacts J and the circuit of solenoid f^2 at contacts h^3 h^4. At the same time the contacts h^5 h^6 engage contacts h^7 h^8, and contact h^{10} bridges contacts J^1. The opening of the circuit of solenoid f^2 permits the signal to go from clear to danger, under the influence of weight b^1. At the same time the solenoid of disabling device K is energized to open contacts k^3 and J^1.

When the car passes from section X to section Y, the signal at station Y^1 is permitted to go to danger, in the manner just described in connection with station X^1. At the same time disabling device K is deënergized, and current is supplied from the power conductor through the car contact section Y, conductor 4, at station Y^1, conductor 12, conductor 13 at station X^1, contacts h^8 h^7 at said station which are bridged by contacts h^6 h^5 respectively, conductor 6, solenoid g^2, conductor 3, to ground. This energizes solenoid magnet g^2 which attracts and raises its core *g* and holds the signal at station X^1 in its intermediate or caution position where it remains as long as the car is upon section Y.

When the car passes on to section Z the signal at station Z^1 is moved to the danger position, as heretofore described, and the

signal at station Y^1 is moved to caution position as just described in connection with station X^1. Current is supplied to section Z from the car contact shoe W, and besides performing the above function at stations Z^1 and Y^1 is supplied through conductor 5 backward past station Y^1 to contacts J^1 at station X^1, which are bridged by contact h^{10}, thence passing through conductor 14 at said station, solenoid I, then returned to ground by conductor 3. This energizes solenoid I which attracts its core thereby opening its own circuit at contacts J^1, opening the circuit connections of solenoid g^2 at contacts h^7 h^8, and closing the circuit of solenoid f^2 at contacts h^3 h^4, thereby restoring the signal at station X^1 to safety position.

In case the car or train the progress of which has just been traced should be behind time, or a car or train following it should be ahead of time or running too close, this latter car entering block or section X before the train in advance had left the block or section Y, then when the train in advance enters section Z ordinarily the signal at station X^1 would be operated from danger position where it had just been set by the following car to clear position. In order to prevent this, I provide the device K, which is energized by current from the main conductor through the car contact at station X^1, conductor 4, conductor 15, solenoid k^1, conductor 10, and returned to ground by conductor 3, thereby separating contacts J^1 to open the circuit of solenoid I which would otherwise be energized when the car in advance enters section Z. The circuit of the caution operating device is also opened, at contacts k^3. Under these conditions, therefore, the signal at station X^1 remains at danger, to warn any trains or cars which follow those upon the sections just mentioned. This position of the circuit disabling device K is indicated at station Z^1 of Fig. 1. It will therefore be seen that as long as any given section is occupied by a car the signal of that section must stand at danger and can not be operated to caution or clear, no matter what other sections are occupied by other cars.

In the embodiment in my system as illustrated in Fig. 1, I have shown diagrammatically a third rail supply conductor A, and a sectional signal rail represented by three sections, Z, Y, Z. The sectional rail is preferably placed in close proximity to the third rail so as to be connected thereto by contact shoe carried by the car which also supplies current from the third rail to the car motors.

In Figs. 2, 3 and 4, I have illustrated a preferred construction of this arrangement in which the third rail A is mounted upon insulators a and carried within a housing strip a^1 preferably of fire-proofed and weather proofed wood the sides a^2 of which project up above the surface of the third rail. The sectional signal rail, represented by X, overlies the third rail and is mounted within and carried by a strip x similar to the strip a^1. The spaces between the ends of the sections of the sectional rail, and the joints of the strip x, are preferably staggered as shown in the figure so that a practically continuous body is formed by this combined housing and its contained sectional rail. The sectional rail housing normally rests upon the housing of the third rail, the two rails, however, being separated by a space so as not to be in contact with each other, and the sectional rail is mounted upon brackets x^1 by links x^2 so as to be capable of an up and down motion but resist lateral displacement. When no car is present the sectional rail housing rests upon the housing of the third rail as shown in Fig. 2, and both rails are effectually protected from snow and ice and weather, and accidental contact of persons or animals with either rail is prevented. The contact shoe W carried by the car enters at the flaring end x^3 a^3 at the end of the route and as it advances raises the sectional rail and its housing, receiving its weight, and thereby making firm contact both with the third rail and the sectional signal rail. After the shoe has passed a given point the sectional rail with its housing returns to its original position resting upon the third rail. In this application I shall claim this rail construction in its adaptation to my signaling system and similar systems only, but it will be understood that this construction and its possible modifications may be employed in third rail electric railways generally, and in this broad aspect, I shall consider it and claim protection in a separate application.

It will of course be understood that the various magnets of my apparatus are suitably wound for the current they are to carry, and other provisions made when found desirable, such as the insertion of resistances when required. It will also be understood that I may employ semaphore arms of the ordinary type, or signals of any approved or preferred construction, instead of those herein shown. It will also be understood that instead of the solenoid magnet operating means for the signals I may employ any other type of electric motor, such as the ordinaty rotary motor.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric railway block signaling system, the combination with a power conductor extending along the way for supplying motive current to the car motors, a signal conductor also extending along the way in proximity to said power conductor and divided into sections which constitute the blocks of the system, a signal biased to danger associated with each section of said

signal conductor and normally electromagnetically restrained when its section is unoccupied by a car or train, and a car-carried contact adapted to engage and connect said conductors to permit said signal to go to danger when a car occupies the section.

2. In an electric railway block signaling system, the combination with a power conductor extending along the way for supplying motive current to the car motors, a signal conductor also extending along the way in proximity to and overlying said power conductor and divided into sections which constitute the blocks of the system, signals associated with the sections of said signal conductor, and a car-carried contact arranged to pass between and to engage said conductors to connect said power conductor with the car motors and with the signals.

3. In an electric railway block signaling system, the combination with a power conductor extending along the way for supplying motive current to the car motors, a signal conductor also extending along the way and divided into sections which constitute the blocks of the system, a signal having a bias to danger connected to each section of said sectional conductor and said power conductor and normally maintained electrically at clear, a controlling device, and car carried means to connect said power conductor to the car motors and to a given section of said sectional conductor to operate said controlling device and set and maintain the signal at danger while the car occupies that block.

4. In an electric railway block signaling system, the combination with a power conductor extending along the way for supplying motive current to the car motors, a signal conductor also extending along the way and divided into sections which constitute the blocks of the system, a signal capable of danger position and additional plural positions connected to each section of said sectional conductor, electrical interconnections between said signals, and car-carried means to connect said power conductor with the car motors and with a given section of said signal conductor to set the signal of the given section at danger and the signals of at least two other sections at positions different from each other and the given section signal.

5. In an electric railway block signaling system, the combination with a power conductor extending along the way for supplying motive current to the car motors, a signal conductor also extending along the way and divided into sections which constitute the blocks of the system, a three-position signal connected to each section of said sectional conductor, electrical interconnections between said signals, and car-carried means to connect said power conductor with the car motors and with a given section of said signal conductor to set the signal of that block at danger, the signal of the first block in the rear at caution, and the signal of the second block in the rear at clear.

6. In an electric railway block signaling system, the combination with a power conductor extending along the way for supplying motive current to the car motors, a signal conductor also extending along the way and divided into sections which constitute the blocks of the system, a station for each section provided with a signal with operating mechanism connected to said power conductor and another section of the sectional conductor and having means for setting the signal at danger, and controlling mechanism at each station for the circuits of said signal operating mechanism electrically connected to said signal conductor.

7. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station and signal for each section of said sectional conductor, two independent means at each station for operating the signal, and controlling mechanism for said means electrically connected to said sectional conductor.

8. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station and signal for each station of said sectional conductor, two or more independent electro-magnetic devices at each station for operating the signal, and electro-magnetic means connected to said sectional conductor for controlling the circuits of said operating devices.

9. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station for each section of said sectional conductor provided with a signal biased to danger, electro-magnetic means for setting and maintaining the signal at clear, and independent electro-magnetic means for setting the signal at caution.

10. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station for each section of said sectional conductor provided with a signal biased to danger, circuit connections between said stations, means at each station for setting and maintaining the signal at clear and released when a car or train enters that section, means controlled from the next section in advance for setting the signal to caution, means controlled from the second section in advance for setting the signal at clear, and means controlled by a car on the given section to prevent the operation of the last named means.

11. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station for each section of said sectional conductor provided with a signal biased to danger,

means normally acting in a given section to set and maintain the signal of that section at clear, means controlled from the same section to permit the signal to go to danger, and means to prevent the operation of said setting and maintaining means when a car or train enters the second section in advance.

12. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station for each section of said sectional conductor provided with a signal biased to danger, means normally acting in a given section to set and maintain the signal of that section at clear, means controlled from the next section in advance for moving the signal from danger to caution position, means controlled by a car on the second section in advance for setting the signal at clear, and means to prevent the setting of the signal at clear when a car occupies the given section.

13. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station for each section of said sectional conductor provided with a signal biased to danger, an electro-motive device to set and maintain the signal of a given section at clear and electrically connected to the supply conductor, an electro-magnetic device controllable from said section to permit the signal to go to danger and from the second section in advance to move the signal to clear, and means controlled from the given section to disable said setting and maintaining means.

14. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station for each section of said sectional conductor provided with a signal biased to danger, an electro-motive device to set and maintain the signal of a given section at clear and electrically connected to the supply conductor, an electro-magnetic device operating to control the circuit of said electro-motive device to permit the signal ordinarily to go to danger when a car or train enters that section, and means for preventing the operation of said electro-magnetic device when a car or train is on the second section in advance.

15. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal station for each section of said sectional conductor, an electro-motive device to set and maintain the signal of a given section at clear, a second electro-motive device to set the signal from clear to caution, an electro-magnetic device controlled by a train in said section to de-energize said setting and maintaining electro-motive device and from the second section in advance to energize said setting and maintaining device, and means to prevent the energization of said electro-motive setting and maintaining device when a car or train occupies said section in advance.

16. In an electric railway, a supply conductor extending along the way for supplying current to the car motors, a signal sectional conductor also extending along the way overlying said power conductor and supported in movable relation thereto, and a car-carried contact adapted to pass between and engage said conductors to supply current to the car motors and said signal sectional conductor.

17. In an electric railway, a supply conductor extending along the way for supplying current to the car motors, in combination with a signal rail movably mounted in close proximity thereto and adapted to be connected by a car-carried contact with said supply conductor.

18. In an electric railway, a supply conductor, extending along the way for supplying current to the car motors, in combination with a signal rail movably mounted and resting upon the supply conductor but insulated therefrom, said signal rail being adapted to be moved and supported by a car-carried contact which electrically connects said signal rail and supply conductor.

19. In an electric railway, traction rails carried by a suitable road-bed, a third rail supply conductor also carried by said road-bed and extending along the way in close proximity to said traction rails for supplying motive current to the car motors, and a sectional signal rail mounted in proximity to and overlying said third rail.

20. In an electric railway, traction rails carried by a suitable road-bed, a third rail supply conductor also carried by said road-bed and extending along the way in close proximity to said traction rails for supplying motive current to the car motors, a sectional signal rail mounted in proximity to and overlying said third rail, and a car-carried contact shoe adapted to pass between and engage said third rail and signal rail.

21. In a railway electric signaling system, a third-rail supply conductor, a cover movably mounted with relation to said supply conductor, and a signal conductor mounted on said cover.

22. In an electric railway signaling system, a third-rail supply conductor, a cover for said third rail mounted in movable relation thereto, a sectional signal rail mounted on said cover, and signal mechanism associated with sections of said signal rail.

23. In an electric railway signaling system, a third-rail supply conductor having a lateral housing, a cover coöperating with said housing to inclose said third rail and mounted in movable relation thereto, a sectional signal rail mounted within said cover in proximity to but separate from said third

rail, and signal mechanism associated with sections of said signal rail.

24. In an electric railway, a third rail supply conductor extending along the way for supplying current to the car motors, a sectional signal rail having a housing which normally overlies and incloses said rails in close proximity to but normally electrically insulated from each other and movably mounted with relation to said third rail.

25. In a railway electric signaling system, the combination with a supply conductor and a sectional conductor, of a signal for each section of said sectional conductor, means tending to maintain a signal of a given section at danger, means controlled from advance sections for setting the signal at caution or clear, and means controlled by a car on the given section to prevent the operation of said signal setting means.

26. In an electric railway signaling system, a third-rail supply conductor for supplying operating current to the car motors, a housing for said supply conductor, a sectional signal conductor mounted within said housing, signal mechanism associated with each section of said sectional conductor, and a car-carried contact arranged to electrically connect said conductors and to supply current to car motors.

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